# DRAGON USER

International edition

The independent Dragon magazine

60p US$2.60 December 1983




A beginner's guide to machine code programming

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The latest in software

**WIN!**
A Dragon 64 from Dragon Data

A new man and a new machine: Dragon's chief interviewed, 64 reviewed

DRAGON USER

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**How to submit articles**

The quality of the material we can publish in *Dragon User* each month will, to a very great extend, depend on the quality of the discoveries that you can make with your Dragon. The Dragon 32 computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

Every one of us who uses a Dragon will be able to discover new tricks and quirks almost every day. To help other Dragon users keep up with the speed of the development each of us must assume that we made the discovery first — that means writing it down and passing it on to others.

Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should be typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

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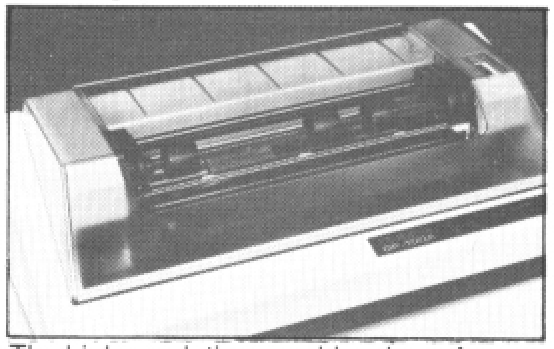


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# Editorial

DRAGON DATA MAY BE carrying coals to Newcastle with the American launch of the 64, but the trip should result in some good news for UK users.

The similarities have often been remarked between the Dragon and Tandy's Colour Computer (or Color if you prefer the spelling which reveals the machine's country of origin). What these similarities come down to is that both micros are based on Motorola's 6809 chip and use Microsoft's Basic. In terms of appearance, there's no resemblance. The Dragon has a different shape, a better keyboard and two extra ports (for a monitor and the power pack — the Tandy machine has an internal power supply so the Dragon runs cooler). Inside the box the differences are even more marked — the Dragon houses a truly international collection of chips. So the trip to the US is being made with a different bag of coals, but the timing turns attention to another similarity, one of memory. Tandy has released its 64K Colour Computer just as the Dragon 64 arrives in the US, although here again there are differences — for instance an RS232 port on the Dragon 64 is missing on its Tandy rival.

But it's the Dragon's software that will be particularly well-travelled. Many of the programs sold by Dragon Data (and by market leader Microdeal) came from the US in the first place — and now they're going back to woo the American market. So why should all this coal-shipping be good news for users? If, or when as Dragon Data would obviously prefer it to be written, the Dragon 64 takes off in the US, more software will be written for the machine. And the lure of a bigger market should persuade American programmers to write for the 64 in 32K mode. Tano, Dragon Data's US partner, is already considering American programs for release and persuading independent software houses to convert programs or write new ones.

And because Tandy is a bigger and more established company, Tano is keen to give itself a strong — and different — identity. It has decided to assist user groups and give as much after-sales support as possible. Dragon Data's new managing director, Brian Moore, has already said that a more "open door" policy is on its way on this side of the Atlantic — the UK may follow the US's lead. Coals to Newcastle maybe, but the return cargo certainly looks promising for the UK.

# Letters

This is the chance to air your views — send your tips, compliments and complaints to Letters Page, *Dragon User*, 12-13 Little Newport Street, London WC2R 3LD.

## Random illusion

IN CASE you have any illusions about random function, try this:

If the Dragon is switched on, switch it off first, then back on. Type in PRINT RND (200) (enter) and note the answer, which should be 100. Type it in again. This time the answer should be 64. Switch the Dragon off and on again and repeat the above. Surprise — you get 100 and 64.

If you want a truly random answer for such things as throwing a dice etc, the secret is to get the Dragon continuously selecting "random" numbers but only printing on demand, such as when any key is pressed. The following routine does just that:

```
10 CLS
15 PRINT "HIT ANY KEY FOR A
   RANDOM NUMBER UP TO
   200"
20 K = RND (200)
30 A$ = INKEY$:IF A$ =
   ""THEN 20
40 CLS:PRINTK:GOTO 15
```

*Ken Reavley,*
*Annan,*
*Dumfriesshire.*

## Program changes

WITH REFERENCE to the programs published in the September edition of *Dragon User*, may I suggest the following improvements:

**Squash** — In the program as written, no resetting of the player's score per game is made at the end of each game. Thus, if the same player "wins" two games in succession, the second game never ends because the score has already passed 11. Thus an additional line is required:

```
651 SC(1) = 0 : SC(2) = 0
```

**Pontoon** — In this program, the computer's hand is reversed to that of the player and on producing the second card for the computer's hand, the first card is blocked out. This can be overcome as follows:

Delete line 230

Add line 241 S = 5: GOSUB 2000

Modify line 380 L = 16

It is possible that the computer could deal itsef two Aces. As written, the program then gives the computer's hand as the winner when it has actually "bust". Thus, an additional line is required:

```
435 IF CT>21 THEN CLS3 :
    PRINT @ 164, "OOPS!
    — I BUST" : FOR A = 1
    TO 2000 : NEXT A: YH =
    YH+1 : GOSUB 50/0 : GO
    TO 500
```

I also found in this program that the in-built delays were not long enough and required increasing to FOR A = 1 TO 2000. Also an additional delay was required:

```
315 FOR A = 1 TO 2000 :
    NEXT A.
```

*S R Holt,*
*Chorley.*

## 65495,0 success

AFTER READING that Dragon users have been saving programs while the machine is running in its double speed mode (POKE 65495,0), I decided to try and find a way of reloading a program saved at this speed. The good news is that I succeeded in doing so.

The dual speed mode only addresses the machine's RAM and input/output at the faster speed, however by using POKE65497,0 all the machine's memory is addressed at the faster speed. When in this mode there is no screen as the computer steals time from the video chip.

To load a program saved in the double speed mode do the following:

POKE65497,0:CLOAD (ENTER)

The screen on your computer should show wavy lines and you will have to watch your cassette recorder to check if the program has finished loading.

When the cassette stops, type

POKE64596,0 (ENTER)

Your screen should return to normal, with a few characters displayed at random. When you type LIST your program should appear.

You may find that the program has been corrupted as the cassette interface was not designed to run at this speed, but in general you should be able to recover your program and save it in the normal way.

*G McQueen,*
*Tyne and Wear.*

## Program error

IN LESLIE Miles' article, about I/O ports (*Dragon User*, September, P33) there is an error in the sample program which might confuse any readers bold enough to try this project.

When the PIA is first switched on all registers are set to 0. Therefore address P+2 is data direction register B — not A as stated. Also, in order to set the port lines to act as inputs the data direction registers must be set to 0 not 1.

Although the program works as expected, line 20 POKE P+2, 255 is, in fact, addressing DDRB and setting port B to output. Because all bits are 0 at switch-on, port A is automatically set to input.

*D Aylwin,*
*Brighton.*

## Manual criticism

A SHORT time ago I came across a magazine listing which I felt I would like to convert to run on my Dragon. Unfortunately, upon reading through it I discovered that it contained a three-dimensional array. Having read my Dragon manual thoroughly when I first bought my computer I remembered that Dragon syntax catered only for arrays to two dimensions.

Nevertheless, I dimensioned it anyway. Imagine my amazement when the Dragon accepted it. Lo and behold — I discovered yet another bug in the now-notorious manual.

I therefore would suggest to Dragon Data that they sack the person who wrote it and commission a new manual. It really is very serious, because the manual is selling the Dragon short and, after all, it is supposed to help people get the best from their new computers.

In short — nice machine; shame about the literature.

*Cameron Black,*
*Glasgow.*

## Memory locations

WHILE POKING around inside the memory of my Dragon 32 I have come across some very useful locations which I thought might be of use to some of your readers.

329 — Lower case on/off.

105/6 — Line number currently being executed.

136/7 — Print @ position in memory.

337-345 — Keyboard check.

426-433 — Name of file being searched for.

434-441 — Name of file being loaded.

226 — 'Play' tempo.

225 — 'Play' note duration.

222 — 'Play' octave.

346-349 — Values of joysticks (0) to (3).

31 — Reserved memory.

*R Brown,*
*Coventry.*

## Stopping a listing

MANY PEOPLE have complained about the fast screen listing. The listing can be stopped at any time by using Shift @ and be restarted by pressing any other key. By using Shift @ and P a two-fingered control is possible and should be very easy for games players who don't use joysticks.

The re-viewing is made even easier if you use lower case figures for the REM statements in your programs — one advantage of the inverse lower case figures on the Dragon is that they show up well on a fast scroll.

*P Wells,*
*London W10.*

## Software Top 10

| | | | |
|---|---|---|---|
| 1 | (1) | **The King** | Microdeal |
| 2 | (3) | **Android Attack** | Microdeal |
| 3 | (–) | **Cuthbert Goes Walkabout** | Microdeal |
| 4 | (2) | **Frogger** | Microdeal |
| 5 | (–) | **Gridrunner** | Salamander |
| 6 | (–) | **Shark Treasure** | Dragon Data |
| 7 | (–) | **Mined Out** | Quicksilva |
| 8 | (–) | **Storm Arrows** | Dragon Data |
| 9 | (–) | **Grand Prix** | Salamander |
| 10 | (6) | **Ring of Darkness** | Wintersoft |

Chart compiled by Boots

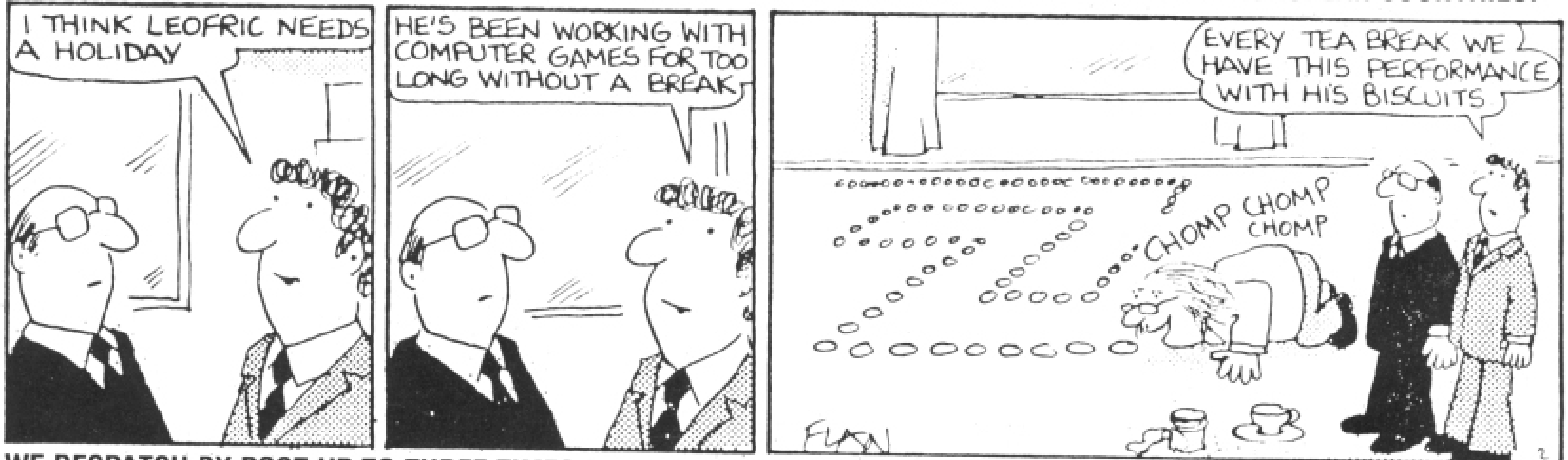


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# Software firms getting adventurous with Dragon

THE PRAYERS of users thirsting for adventure are being answered — by Channel 8 Software, Richard Shepherd and Phoenix, among others.

Channel 8 is transferring the celebrated Mysterious Adventures — 10 in all — to run on the Dragon.

The games, including the Golden Baton, Time Machine and Escape from Pulsar 7, will be released in January at £9.95 each. Channel 8's address is 51 Fishergate, Preston, Lancs.

Richard Shepherd Software is starting off with two releases, but more will follow if these are successful, including some originals.

First out are versions of Spectrum favourites. Transylvanian Tower and Super Spy, at £6.50 each.

Richard Shepherd explained that converting from the Spectrum to the Dragon involved "cutting your code to suit your cloth".

The Dragon versions are faster and have a better range of sound but there were problems with colour combinations. Running text on the hi-res screen had also proved difficult but ways had been found round this.

In Super Spy you have to locate the secret island and then decode the nuclear missile on the island. If you're successful you're rewarded by a rendition of God Save the Queen.

Transylvanian Tower is a 3D real-time adventure. The tower has five levels, each with 100 rooms — with the order of the rooms and location of objects changing each time you play.

There's also a certain amount of arcade action, as you have a laser gun to blast bats with.

Richard Shepherd Software can be reached at Elm House, 23-25 Elmshott Lane, Cippenham, Slough, Berks.

Phoenix Software is also offering a combination of arcade and adventure thrills — on separate cassettes.

Its twin-cassette Death Mines of Sirus is the first in a series of titles, each at £9.95.

In the arcade part of the game you have to master 12 skill levels after which you are given the running code for the adventure cassette.

Also, at the end of each skill level, a clue to the adventure is flashed on the screen.

Phoenix Software's address is Spangles House, 116 Marsh Road, Pinner, Middx.

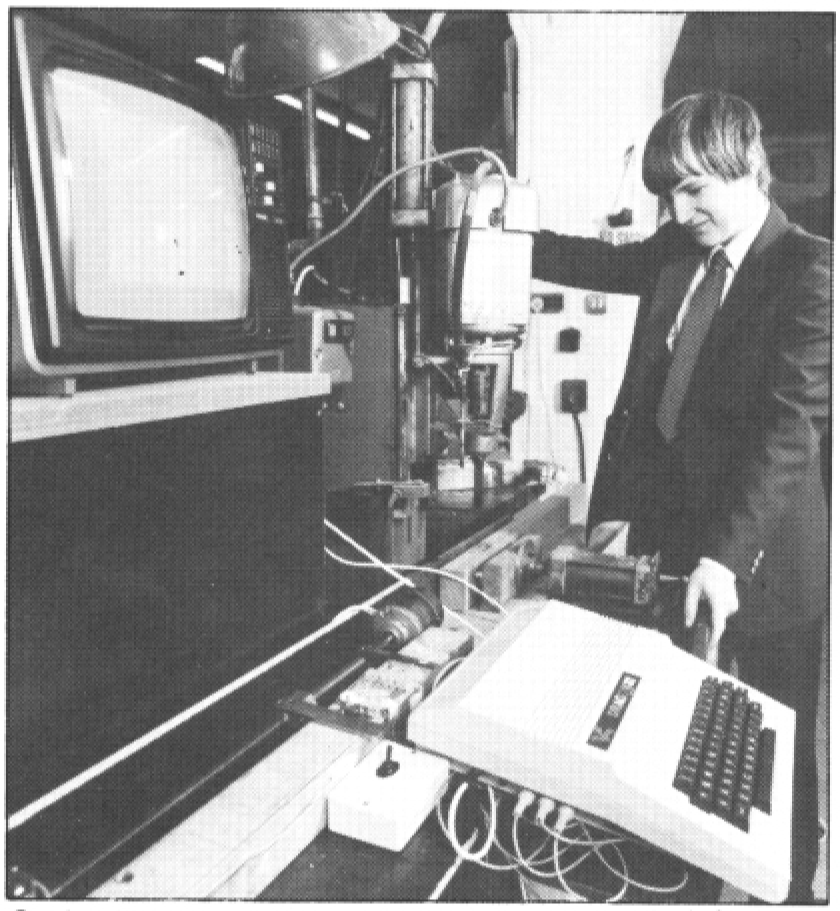
# Stephen's 32 pays its way

SEVENTEEN-YEAR-old Stephen Hurcombe, of Abbeydore, Hereford, knows how to make his Dragon pay its way. He's just proved it by winning £1,250 in a national microelectronics contest. Stephen took first place in the first national MicroQuest competition run by Williams and Glyn's Bank in association with MAP, the Department of Trade and Industry's Microelectronics Applications Project.

Entrants, aged between 16 and 21, had to design a new and practical use for microelectronics in British industry. Stephen incorporated his Dragon 32 into a control system for operating a mortise cutter at his father's firm, which makes storm porches.

Stephen, an apprentice at British Telecom International's Madley Satellite Earth Station, has been interested in electronics since he was 11. He has had his Dragon — his third computer — for just over a year.

He plans to use the prize money to buy more computer equipment and is hoping that, with the assistance of MAP, his idea can be developed commercially.



*Stephen Hurcombe puts his Dragon 32 to work at his father's factory*

Another MicroQuest competition will be run next year, so anyone interested has plenty of time to plan ahead.

If you've got an idea and can't wait until then, why not try our competition at the back of the magazine? Your idea could win you a Dragon 64 from Dragon Data.

# Centipede a foothold for Atari?

CENTIPEDE IS the first game for the Dragon from Atari — but others will follow if it is a success.

Atari's software division has converted its arcade games to run on other home micros, including the two Commodore machines as well as the Dragon.

Centipede comes on cassette and costs £14.99. This may seem expensive for Dragon software but Atari argues that its games are "second-to-none, therefore the price is not too high in terms of what you get".

Atari is waiting to see how Dragon Centipede fares before deciding on follow-ups.

# Dungeon means business

DRAGON Dungeon is getting to grips with the business software market following last month's batch of adventures.

Its Dungeon Software offshoot has released Cash-Flow and Catalogue, Sort & Mail — both at £8.75.

Cash-Flow is a menu-driven program which will manage money for either the home or a small business. Functions include account and new data balances, setting up and listing of accounts, and output to printer.

Catalogue, Sort & Mail is a menu-driven program filing system which sorts data within user-defined parameters.

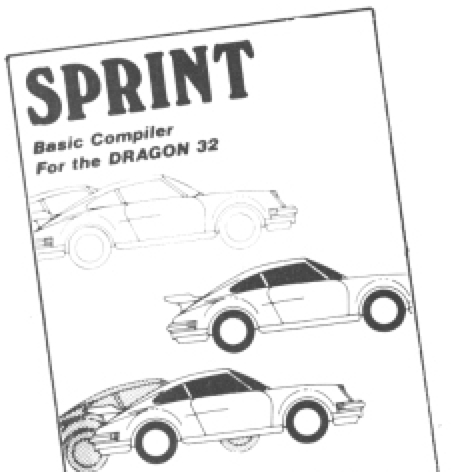


# NEW RELEASES FOR CHRISTMAS FOR THE DRAGON 32

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# Adventuring in a big way

SHARDS SOFTWARE has hit the adventure trail in a big way, producing what managing director Stephen Maltz claims to be "the largest adventure ever written for the Dragon 32".

Shards' Pilkington's Diary takes up over 90K of memory and is played in three parts. It takes the player from the streets of London to a trek across Europe in a mixture of high resolution graphics and text adventure formats.

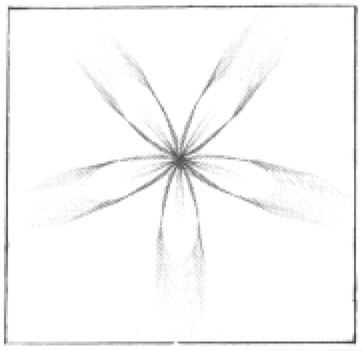
Says Stephen: "It's a game for all the family. Different parts of the game cater for different members of the family. For example, there's a bit where fast typing is a help — that's where Mum might come in."

Pilkington's Diary is available now, but the company is working on two others — a fishing simulation and a game called North Sea Oil, actually written by an oil rig worker — for Christmas/New Year.

# Help is here for artists

HIGH resolution artists who want to preserve their creations on printouts are being offered more help.

A cassette program from the Dragon 32 Users' Club allows you to draw on the hi-res screen and, when you are happy with your colour graphics, dump the contents straight on to the MCP40 printer.



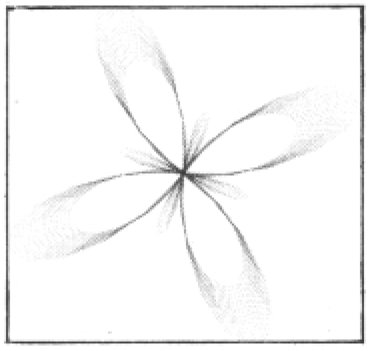
This printer is available at a reduced rate to members of the club, whose address is 31 North Street, Wareham, Dorset.

A similar program form Deltasoft can be used with the Tandy CGP 115 as well as the MCP40.

The club's program costs £5.95 while Deltasoft's is £4.95. Deltasoft can be reached at 40 Windsor Road, Doncaster.

Users with a Seikosha GP100A should try Caveman Computers whose screen dump program also works with the Tandy DMP100.

Caveman's program costs £7.95 — the company is Windy Nook, Gateshead, Tyne and Wear.



# Simplicity pays off

THE LIST of add-ons for the Dragon continues to grow — except that now manufacturers are going for simplicity, as can be seen by the latest offerings from Elkan Electronics.

The company's latest accessories are the sort of things that solve the "little problems" that often plague micro owners.

For example, the "Dragon's Eye" could be just the thing for those forgetful Dragon owners who leave their micros to overheat. It's an on-off indicator that plugs into a spare joystick socket.

It sells at £3.95 and helps you remember not to load a cartridge or disk drive into the cartridge port when your Dragon is still switched on.

Elkan is also marketing a "Dragon's Tail", which can extend your joystick by one metre, for £2.95, and a "Dragon's Fork-tail" which lets you use the joystick port for two purposes at once. This sells at £3.95.

# Another string to the past cut

ANOTHER STRING connecting Dragon Data to its past is being cut as the company celebrates its first year of independent operation.

Toy-maker Mettoy, a shareholder in Dragon Data and the founder of Dragon computers, went into receivership at the end of October — nearly a year after selling Dragon Data off to a consortium of investors.

Brian Moore, Dragon Data's managing director, received the news with regret, but emphasised that his company would not be affected.

"Dragon Data is a fully independent company and the news of Mettoy's receivership can have no significant effect on the running of this company," he commented.

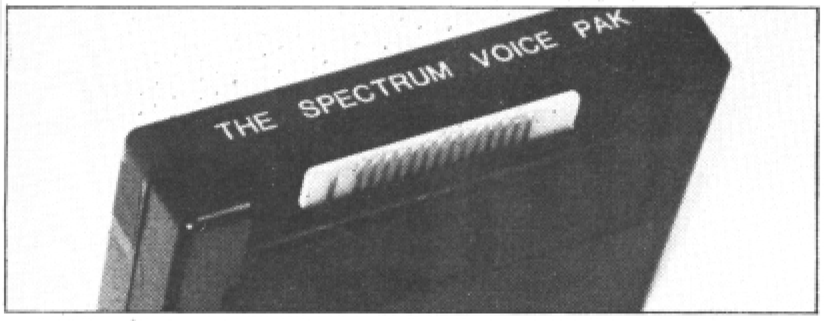
"We anticipate, therefore, no change in the continuing growth of this company as a result of the news."

Mettoy's receivers are negotiating sales of the firm's assets, including its 15.5 per cent shareholding in Dragon Data. The other shareholders in Dragon Data have the first option on that holding.

Pru-tech, the high-tech investment division of Prudential Insurance, has the largest holding, with 42 per cent. The Welsh Development Agency is next with 23 per cent. The other shareholdings are all less than Mettoy's.

This consortium of investors was formed last November to purchase Dragon Data from Mettoy, just three months after the launch of the Dragon 32.

Dragon Data had begun life the previous spring as a Mettoy subsidiary.




# Speech synthesis American-style

SPECTRUM PROJECTS of New York thinks it's time you started talking with your Dragon — preferably by buying the Voice Pak it has produced (pictured).

This phoneme-based voice system uses the Votrax SC01 chip synthesiser in a cartridge pack. It costs $99.95, including postage and packing, and comes with user instructions — but not with an American accent.

The Pak provides automatic or user supplied inflections, plus four programmable levels of pitch "with an unlimited vocabulary". It also contains a text to speech scanner translator and a word manager that will construct and edit user dictionaries.

Bob Rosen of Spectrum Projects adds: "With a single line of code, Voice Pak adds speech to any Basic program in minutes."

The Pak is a version of a speech synthesiser that Spectrum Projects has been selling for the Tandy Colour Computer.

The company has now had a long relationship with 6809-based systems and has converted other software to run on the Dragon.

For example, it is also offering the Stripper — a machine code utility which strips your Basic programs of such things as REM statements and unnecessary spaces.

Spectrum Projects can be reached at 93-15 86th Drive, Woodhaven, NY 11421, USA.

**Each month we write about one particular club — if you think yours should be featured here write to Clubs Page, *Dragon User*, 12-13 Little Newport Street, London WC2R 3LD**

# The Dragon family grows

*The British Dragon network grows! This month we discover and take a brief look at seven more clubs for Dragon users*




1. FIRST UP in our list of "recent discoveries" is a club that has been around almost as long as the Dragon itself. The Droitwich Computer Club has been going since September 1982 and has escaped our notice until now probably only because it is a general computer club rather than just one for Dragon users. But it does have Dragon owners among its members and would certainly welcome more.

Members meet in the Walnut Room of the Norbury House on the first and third Wednesdays of each month. The entry fee the club charges to cover the rent of the room is: children 30p, adults £1.

For information on the club readers should contact A R Middleton at 14 Primsland Drive, Cherry Hill Estate, Droitwich, Worcester WR9 7QR or ring on Droitwich 775 570 after 6 pm.

□ □ □

2. SCOTLAND ALREADY has one club for Dragon users, the Scottish Dragon Club in Edinburgh. But, as Stewart Hutcheon of Glasgow points out, its position in the Scottish capital makes it a little awkward for him and his fellow Glaswegians. Stewart would like to hear from anyone else interested in forming a club in Glasgow. He can be contacted at 12A Firbank Terrace, Barrhead, Glasgow G78 2PX or on Glasgow 880 5610.

□ □ □

3. ANOTHER DRAGON owner hoping to start a users' group in his area is Paul Kennedy of Ware. Paul would like to hear from anybody else interested. His address is 61 Broadmeads, Amwell End, Ware, Herts. Phone Ware 68264.

□ □ □

4. LIKEWISE J R Griffin of Slough. He's got a small group going already but is looking for more members. If you're in (or near) Slough and interested write to 1 Garrard Road, Britwell Estate, Slough, Berks or phone Slough 35268.

5. MEMBERS OF the Sheffield Dragon Users' Club would certainly appear to be getting their money's worth. Although still fairly small (but growing, we are told) the club has secured 5 percent discount for members at the largest software shop in the area and even produces a monthly newsletter which is issued free to every member. The fees? — Nothing, yet.

Monthly meetings are informal (alternating between a pub and the Sheffield City Polytechnic) and consist mainly of software swapping, "keyboard bashing" and discussions about the latest equipment.

Anyone interested in joining should contact Richard Crampton, 131 Herringthorpe Valley Road, Rotherham. Richard's phone number is Rotherham 851 545.

□ □ □

6. IN NOTTINGHAM Dragon users have carved a little niche for themselves in the Nottingham Micro Computer Club. Its Dragon User Group meets Monday evenings at the Congregational Centre, Castle Gate, Nottingham. Guest speakers are often invited to the meetings.

Dragon owners interested in joining the group should get in touch with Mike Johnson, "Rutland", 19 Gateford Close, Bramcote Moor, Beeston, Nottingham. His phone number is Nottingham 288 541.

□ □ □

7. FINALLY, SOMETHING for those with an interest in the 64. The OS-9 User Group has been set up to promote the development of commercial packages. Equipment available to members will be centred on the new 64 and languages will include Basic 09, Pascal, C, Cis Cobol, Assembler and Sage.

Meetings are scheduled for three times per week: Tuesday and Wednesday 7 pm-10 pm; Sunday morning 10 am-1 pm. Subscriptions will vary according to "status of membership", from junior to commercial.

For further information contact: OS-9 User Group, 1st Floor, 16 New North Parade, Huddersfield HD1 5JP. Telephone 0484 516179 (day) or 0484 864130 (after 6 pm).

## Dragon clubnet

**Derbyshire:** Dragon Owners' Club, Dragon Dungeon, PO Box 4, Ashbourne, Derbyshire — publishes *Dragon's Teeth*.

**Devon:** Ian Chipperfield, Brixham Dragon Owners' Club, 22 Brookdale Court, Brixham, Devon — meets every Saturday afternoon.

**Dorset:** Dragon 32 Users' Club, Games and Computers, 31 North Street, Wareham, Dorset — publishes newsletter.

**Essex:** Doug Bourne, Dragon Independent Owners' Association, School House, Nevern Road, Rayleigh, Essex — publishes *The Dragon's Tale*.

**Lancashire:** Melvin Franklin, North-West TRS-80 Users' Group, 40 Cowlees, Westhoughton, Bolton, Lancs — growing number of Dragon users, meets monthly at Irlam near Manchester and publishes newsletter.

**London:** 68 Micro Group, 41 Pebworth Road, Harrow, Middlesex — publishes *68 Microcosm* and meets on the fourth Tuesday throughout the year in the Regent's Park Library, Robert Street, London NW1, all 68XX owners welcome.

**Staffordshire:** Tony Beckedd, Tame Computer Club, 57 Adonis Close, Tamworth, Staffs — an all-user club including 15 Dragon owners, meets fortnightly.

**Wales:** Dragon Users' Club — publishes Stop Press. Dragon Data, Kenfig Industrial Estate, Margam, Port Talbot, West Glamorgan.

**Wiltshire:** R Gould, 39 Cullerne Road, Stratton St Margaret, Swindon, Wilts — interested in forming Club 32.

**Scotland:** David Anderson, Scottish Dragon Club, 1 Walker Street, Edinburgh — regular newsletter.

**South Africa:** Ian McCall invites other SA Dragon owners to contact him at 35 Silwood Road, Rondebosch, Cape Town.

# Price tags mar the good games

***John Scriven** weighs up the pros and cons of yet another month's offering of software*

THIS MONTH'S SELECTION is quite a mixed bunch. Microdeal continues its attempt to rule the world — or, at least, the part inhabited by Dragons — and has five new titles. Dragon Data has released a wide variety of games and educational software, and there are some new names hidden among the old favourites.

In Shark Treasure (Dragon Data), the object is to send divers from a small boat to collect gold bars from the sea-bed. Each diver is controlled by the cursor keys and the response is fast. The problem lies in avoiding the sharks that swim across the screen in both directions. These are not chunky block graphic creatures, but sleek, blue monsters that snap at anything close to their heads. The display is of a very high standard and the game good fun to play, though not really for the squeamish.

I was rather surprised to see the price quoted for this piece of software as being £12.95. I can see the reasoning behind the high price of some utility packages as they can be used to extend the facilities of the computer, but most games have only a limited interest lifetime. Programs for the Dragon tend to be more expensive than those for the Spectrum, but a price of almost £13 is going to discourage many people from buying this tape, no matter how good the content.

Doodle Bug is another expensive Dragon Data program, but at least the fact that it is on cartridge is some small justification for a £20 price tag — but even this is questionable.

A cartridge usually consists of a cheap box, a small circuit board, and either one or two EPROMS. The manufacturing cost cannot possibly be more than £4-£5, and yet the selling price is consistently £10-£15 more than the equivalent tape. Most people I know with a collection of games tapes have no more than one or two cartridges simply because 1 cartridge = 3 cassettes in price terms. If Commodore can reduce its cartridge prices, so can other manufacturers. Lower prices would undoubtedly increase sales.

## Value for money?

What novelty and originality do you get for your hard-earned £20? In the words of Paul Daniels, "not a lot" — certainly not £20 worth. As you switch on, the display looks suspiciously like Pacman, and that is what this game turns out to be. Although the walls have several swing doors, and there is variety in the articles littering your path, it is still a maze-pursuit game like Cave Hunter and Ghost Attack. Someone at Dragon Data must really suffer from Pacmania. If you don't yet have a version of this old favourite, Doodle Bug can be recommended as having many extra features, but it still doesn't justify the high price.

Better value is achieved with Storm Arrows, which Dragon Data has sensibly priced at £7.95. The display consists of a grid inhabited by hostile arrows. The object is to destroy all eight arrows before they destroy you by firing your "lazer" at them. As laser is in fact an acronym for Light Amplification by Stimulated Emission of Radiation, then "lazer" must have something to do with lazar — "one afflicted with a loathsome and pestilential disease", as my dictionary puts it(!) The game itself is fast and exciting and the graphics, although not outstanding, are perfectly adequate for this type of game.

## Under review

| | | |
|---|---|---|
| Dragon Data<br>Kenfig Ind Est<br>Margam<br>Port Talbot<br>SA13 2PE<br>West Glamorgan | **Doodle Bug** | £19.95 |
| | **Storm Arrows** | £7.95 |
| | **Shark Treasure** | £12.95 |
| | **Circus Adventure** | £7.95 |
| | **School Maze** | £7.95 |
| | **Number Puzzler** | £10.95 |
| | **Number Gulper** | £10.95 |
| | **Hide and Seek** | £10.95 |
| | **Timscript** | £7.95 |
| Microdeal<br>41 Truro Road<br>St Austell<br>Cornwall | **Tele-tutor** | £25.00 |
| | **Crazy Painter** | £8.00 |
| | **Cuthbert in the Jungle** | £8.00 |
| | **Cuthbert goes Digging** | £8.00 |
| | **Intergalactic Force** | £8.00 |
| | **Keys of the Wizard** | £8.00 |
| Dungeon Software<br>Milton House<br>St John Street<br>Ashbourne<br>Derbyshire | **Maths Trek** | £5.95 |
| Virgin Games<br>Portobello Road<br>London W11 | **I Ching** | £6.95 |

From the hi-tech world of arcade pursuits to more homely surroundings. Imagine the scene — you have decided to paint the floor and it's taken you hours to get it just to your satisfaction. You stand back and admire your work when the neighbours' mongrel, looking rather like Spotty Dog from the Woodentops, comes bouncing in, leaving a trail of footprints. You rush to repair the damage only to discover that you've run out of paint. Returning to the scene with dripping brush, you discover a moth has crawled along the top, a worm has entered from the side and Spotty Dog has returned.

These are just a few of the things you have to contend with in Crazy Painter from Microdeal. There are eight levels of difficulty, and a high degree of frustration. The unpleasant creatures that try to ruin your brushwork increase in number as the difficulty goes up, and your pots of fresh paint rapidly disappear from the base of the screen. Occasionally, the display changes to paint slowly dripping from the top, and the object then is to prevent it reaching the bottom. Bonus points are awarded according to how long you delay your fate. This is an original idea and makes a pleasant change from the usual space games. To add to your irritation, there is even a rendition of "Whistle While You Work" in the background!

## Cuthbert's welcome return

Last month I looked at Cuthbert Goes Walkabout, with our unfortunate hero attempting to light up the Lunar Landing Pad. Microdeal must be hoping that Cuthbert will become the Dragon equivalent of Horace, whose exploits on the Spectrum are always entertaining. This month, Cuthbert returns on two cassettes, digging graves for his enemies and seeking treasure in the jungle.

Cuthbert Goes Digging is just like Bonka from J. J. Morrison Micros. You control a small figure who scurries from level to level round the screen digging holes in front of the evil Moronians. On luring them into a hole, he has to fill it in quickly before they leap out and electrocute him. The game increases in difficulty as you progress and there is the added complication of running out of oxygen as you race around. You can choose between joystick or keyboard control and the game becomes fast and furious at the higher levels.

Although I preferred "Digging" to "Walkabout", my favourite is Cuthbert in the Jungle. Using the joystick, you control Cuthbert's tiny figure as he runs to the left and right and jumps over logs. When he reaches the side of the display, a fresh screen appears with new hazards that must be defeated. These include pits, quicksands and alligators. Occasionally, Cuthbert has to emulate Tarzan and swing on hanging vines. Farther into the game, he encounters various treasures that have to be brought back before his time runs out. I enjoyed this game a lot, as it is necessary to build up skills in the early stages before you are competent enough to deal with the later hazards. Each time you play, you improve and get closer to ▶


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◀ the treasure (or like me, eaten by the alligators). The graphics are superb and the response is very fast — certainly my favourite game of the month.

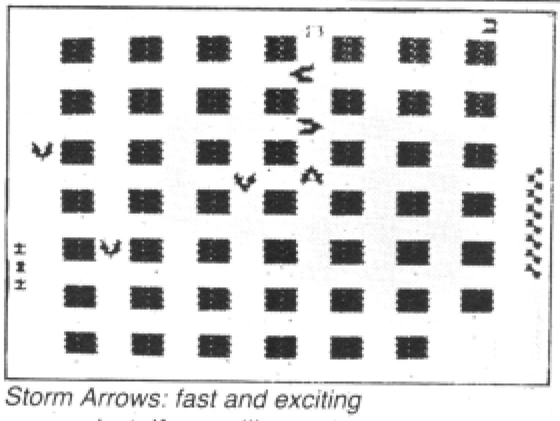
Towards the end of Star Wars, there is a chase sequence for several minutes down the interminable canyons of the Death Star. This has inspired several games programmers, including the author of Intergalactic Force (Microdeal). The walls and floor rush by as you attempt to drop bombs on to enemy space ships beneath you. Fighters spoil your aim by showering you with highly accurate laser bombs. With special permission from Isaac Newton, you are allowed to suspend gravity for a while as you drop bombs upwards but this is not an easy task. There are two speed options, three skill options, and control is by means of joysticks. If you like arcade games, then you should find this fast and challenging, as well as keeping your trigger finger warm on winter evenings.

## The adventure trail

I have not seen any new adventure programs for some time (I think the editor is afraid he might have to send a search party out after me one month), but this month Microdeal has released Keys of the Wizard. Although this is a text-only adventure, it is played in real time, so you have to be quick to enter your instructions. The display contains detailed room descriptions and exit routes, while the top line gives you constant status reports on your own condition and that of the eight creatures that inhabit the game.

The object is to explore many locations, fighting dangerous creatures and collecting treasures. At the beginning, you can select the skill level from one to three, and the instruction sheet gives a large list of recognised commands. If the game continues for a long time, you can enter QUIET to freeze the action, while you do the washing-up or go for a walk. If you wish, you can save the game status on cassette at that point, or you can type UNCLE (?!) to end the game. As with all programs of this nature, it is essential to draw a map as you proceed. This is a well-constructed adventure, and is of a higher standard than the Williamsburg and Jerusalem adventures that Microdeal released earlier this year.

Any more details will give too much



*Storm Arrows: fast and exciting*

away, but if you like unicorns, orcs and jesters, and are skilful with scimitars and mattocks, you will enjoy this game.

If you wish to lure very young minds into the dark world of adventures, then you may wish to consider Circus Adventure from Dragon Data. Rather than being thrown in at the deep end, this is more of a gentle paddle in the black arts. The game is set in a typical circus, and the object is to find the popcorn stand in the minimum number of moves. There are rather basic block graphics to show the trapeze, the tigers cage, etc., and each location has only two exits. The game is aimed at primary children, but only those up to nine or so would play it a lot. If you press BREAK (not disabled) and list the program, you may wonder how Dragon Data can justify the £7.95 price — only 5p more, and you could have Keys of the Wizard.

## Graphics disappointing

A similar criticism can be levelled at School Maze — if the format has to be kept simple as it is aimed at children, then the program should offer better graphics and sound so that you feel you are getting something more substantial for your money. The object of the program is to find a missing computer tape hidden in a school. A map is shown at the start and at various times during play. There are only two exits from each location, and most rooms are illustrated by some block graphics. In the kitchen you can choose what you wish to eat, play tunes in the music room or draw pictures in the art room.

If children of six or seven can cope with Circus Adventure, then those of nine or ten should have little difficulty in playing School Maze. Although these two programs are easy introductions to keyboard use in general and adventure games in particular, it would be more realistic pricing to put both programs on one cassette.

From programs that are designed for children to use, it is only a small step to educational programs. There are several of these this month, and they fall naturally into two groups. The first of these is that of formal computer assisted learning. Teletutor from Microdeal is a very workmanlike set of programs, firmly packaged in a stiff A4 folder. When you pick it up, you can tell they mean business right from the start. It should, however, be admitted that there are only ten sheets of brown paper inside the folder, and two cassettes in a flap in the cover. One gets the impression that this is a slight case of over-packaging, perhaps to justify the high price.

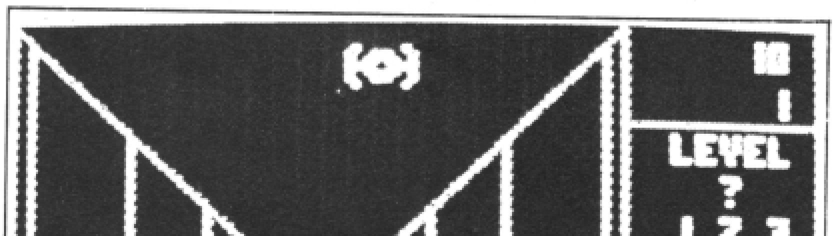
## Do-it-yourself education

The first two programs, Spelling Test and Word Drill, contain sample files on cassette to demonstrate how they work, although in practice you would want to enter your own words. The documentation explains clearly how to do this. The cassette plays a word through the TV speaker and this has to be entered carefully at the keyboard. After the test, the words are shown on the screen and can be copied on to a printer.

Word Drill is a multi-choice vocabulary quiz. Again, the demonstration file shows you how to use the program. The screen format is word, followed by eight selected definitions, from which the correct response may be entered before the preset time limit has expired. The program is menu-driven and easy to use.

Maths Drill covers the four rules (addition, subtraction, multiplication and division), and it has several features — up to six children can use it at once, there are ten levels of difficulty that adjust automatically to the responses, there is a timer function and "smiley faces" are used as a reward.

Estimate follows a similar course to Maths Drill, except that it is designed to practise mental arithmetic. The complete package originates from Tom Mix in the States (a far cry from Donkey Kong!) and has rather obvious American educational tinges — the smiley face, for example, although there is nothing there that would be upsetting for an English educa- ▶




*Intergalactic Force: a good game for arcade addicts*



*Crazy Painter: a pleasant change from space games*

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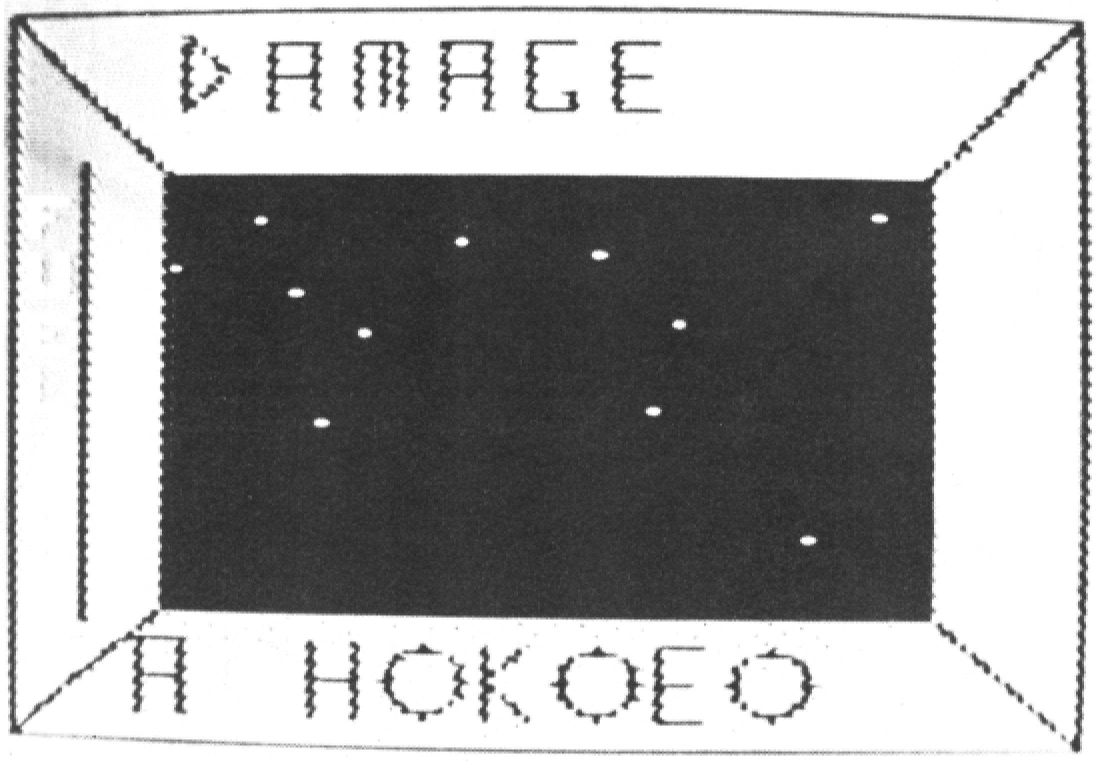
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*Maths Trek: could encourage children who don't find maths an interesting subject*

◀ tionalist. It is, however, not exciting in presentation, and a little restricting in the way in which you can enter answers — in long multiplication, for example. Children would not be over-impressed with it, and it makes no attempt to explain why incorrect responses are not right. If a child already had the various concepts, then these programs would provide a way of reinforcing them, but the responses would tend to be conditioned rather than made with any understanding of the processes involved.

Maths Trek from Dungeon Software attempts to bridge the gap between a drill program and a game. Based loosely on that well-known crew who boldly go, etc., the object is to rise from a lieutenant to a general (I don't know what Captain Kirk would have to say about that!). The screen swops between a view of the bridge of the Enterprise, complete with dials and star-screen, and a status display board showing warp speed and distances to the next star-base. The Enterprise is moved by successfully answering maths problems in the four rules, square numbers or areas. Various hazards, such as Klingon attacks and Black Holes impede your progress and it takes several missions to complete your rise through the ranks. Although lacking in the excitement of the usual Startrek games, it might encourage children who don't find maths an interesting subject. I feel that if this was used with children, the difficulty level would have to be set rather low. I was asked for the square of 217, and that was only on level 25 out of the possible 50!

## Education leader

The most professional and carefully produced educational software this month comes from Dragon Data, although the programs were written by Applied Systems Knowledge Ltd. who sell their own software for other machines such as the BBC micro.

Number Puzzler allows you to choose between five different games — addition, subtraction, adds and subs, magic squares and self-test. The first three games use the same format — four sets of noughts and crosses boards that contain numbers between 1 and 99. Using numbers that appear at random at the bottom of the screen, the object is to fill the boards in, in the same manner as bingo. You can play against the Dragon or against a human partner, and the first line of three numbers filled in produces the winner.

In Magic Squares, the computer produces numbers for you to insert in a ▶

◀ frame on the screen to form a square that is as magic as possible — in other words, one that adds up to the same answer in each row and column, as well as diagonally.

All A.S.K. programs use a symbol of a hand and finger to denote pushing the space bar, and they are all very well error-trapped — only those keys actually needed for a response can be entered. At any time, during the course of the program, you can return to the start by pressing shift and an arrow key.

Hide and Seek is designed to encourage and develop short-term memory and other skills important in learning to read. There are several versions of the program available, but all consist of nine boxes containing pictures of objects and their associated names along the bottom of the screen. You either have to press the ENTER key when a cursor is over the correct box or enter the name of the picture spelt accurately. The pictures are fairly unambiguous and the program clearly achieves most of its stated aims in helping children acquire early reading skills.

## Maths arcade-style

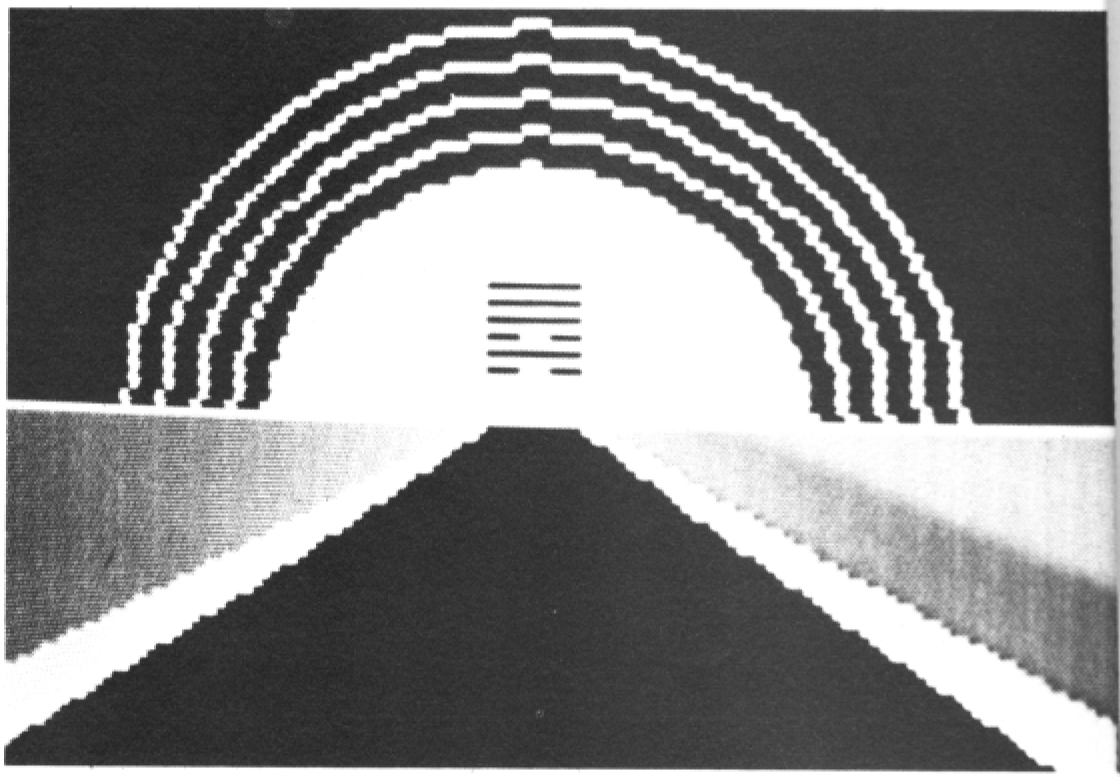
Number Gulper is the closest you could get to an arcade maths game. At the start you decide on whether you are going to use the keyboard or joysticks and then enter the target number. The display changes to a board with a yellow track around which you steer your small gulper. As it passes over various numbers, you can add them to your score as you attempt to reach the target number. The numbers are prefixed by +, −, × or ÷, so you could reach 100 by entering +2, +3, ×4, +6, −1, ×4. At the end, you are raised to a higher level or demoted, depending on how many gulpers you have left. There is also the option for a self test. Children seem to enjoy this program greatly, and as there is a time limit, it encourages fast mental activity.

These three cassettes all cost £10.95, which I feel is rather excessive, but there is no doubt that they are above average and you may feel they would be worth having in an educational collection.

## Oriental flavour

Virgin Records expanded through the 70s from a few retail outlets to producing its own records and now has fingers in several pies throughout the leisure industry. Recently it moved into computer software with a range of titles for different machines. The first Dragon tape I have come across is I Ching. This is a rather esoteric choice for one of their early releases, and may not be particularly accessible to many Dragon owners.

According to early Chinese philosophers, all things that happen in the universe affect all other things — a similar theme was present throughout the tracks on the last Police LP. This interdependence is like seeing the cosmos as a large machine, where all the parts affect the whole and each other. It is like having a brake shoe slightly out of adjustment in a car. This can cause the brakes to pull, putting a strain on the steering, the other brakes, the engine and ultimately, the driver. The patterns and changes in the universe can be seen in all things, from the fall of coins to the selection of bundles of plant stalks. Taoist philosophy would not attempt to change the future, merely to "go with the flow" given the state of play at any particular time. These ideas were very popular with hippies in the late 60s.



*I Ching: if you're on electronic hippy, this could be an ideal buy*

The original method was to think of a problem, such as "how can I do this review and go to the pub" and to cast three coins or select a bunch of yarrow twigs from a pile. This was repeated six times to build up a hexagram of solid or broken lines. You will realise that there are 2 to the power of 6, or 64 different combinations that can result. The Chinese saw these as symbols of real things, such as thunder over water, or fire over a lake. King Wen wrote down commentaries on each combination. The I Ching is a book that contains these interpretations and it is supposed to offer an intuitive approach to solving the initial question.

The Virgin program gives detailed instructions on the screen, then tells you to think of a question while you press the space bar. A road leading into an enormous arch appears, and the hexagram is built up a line at a time. As the final line appears, the screen shows a description of the hexagram and a brief commentary.

The program is well-written and the displays are clear. I feel, however, that the sort of person who would cast the I Ching would be happier to use coins or sticks in a darkened room, heavy with incense. A copy of the book in translation will cost you the same as the program and give you hours of interesting reading and insight into Taoism and its links with some schools of modern psychology. Just as I have never seen the point of computerised phone books — just as quick to look it up in the paper version — this program seems to be more of a clever exercise than a useful tool. However, if you are an electronic hippy, it might be just what you're after.

To finish off this month, ik yw lk to hear ab a new pc of software from Dragon Data tt mt mk it faster when yv to tp le/s. Timscript is designed to recognise two letter combinations that are not in themselves words, and convert them on the screen into normal English. Hence the strange sentence above, which would appear on the screen as "I know you will like to hear about a new piece of software from Dragon Data that might make it faster when you have to type letters." There is a dictionary already supplied on cassette, or you can enter your own, and there are a possible 26 x 26 or 676 combinations to use (less words like on, be, etc.).

As well as this facility, there are limited word-processing features such as automatic word-wrap, line move and delete, and a menu-driven load/save/print option. The documentation is very full, and comes in the form of a 40-page booklet. Although an interesting idea, I would have reservations about its usefulness. It is designed to save time in typing, and yet it would take some time before you felt competent at using the abbreviated forms.

If you think it's worth the effort of learning to use, then it's definitely the sort of program to try our in a shop before you purchase.

## A sign of things to come?

In this collection of software, there is only one true space arcade game. Whether this reflects a changing mood, I don't know. It certainly takes a weight off my shoulders knowing I no longer have to defend the earth from the swarms of aliens that usually descend on my head each month. In some ways, software themes echo the course of Science Fiction movies from the 50s onwards. The philosophy of early flying saucer films was "if it's an alien, shoot it", rather similar to the westerns, where it was a case of "if it's an Indian, shoot it".

Just as heroes in the movies began to have intelligence and sensitivity, so the programs of the future will require you to have more than just a fast finger in order to be successful. ■

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# The 64: how it rates

***Keith and Steven Brain***
*benchtest the Dragon 64*

THE DRAGON 32 has been a very successful machine, with over 100,000 produced in the first year; but in the micro business nothing stands still for long, so Dragon Data has supplemented its range with the Dragon 64. This includes all the features of the Dragon 32, which of course will be very familiar to readers of *Dragon User*, the main additions being 64K of RAM memory, a serial input/output (RS 232) port, and a keyboard autorepeat routine. This machine is essentially the same as the Dragon model available for the past couple of months in the US through Tano (in a co-operative venture with Dragon Data) except that it is built to UK power and TV standards.

## Familiar sights

At first sight the new Dragon 64 looks just like the well-established Dragon 32 as the same case and keyboard are used, although the case is grey instead of beige (to indicate the 'enormous memory' perhaps?) and the number on the logo has changed. A closer inspection reveals an extra socket, labelled "S I/O", has appeared on the left side of the machine, next to the right joystick port, and the old "P I/O" port has been renamed as "PRINTER".

On power-up the familiar start message of the 32 appears and if you PRINT MEM you will be surprised to find that the answer is 24871 — exactly the same as on the old 32. The reason for this is that Dragon Data has taken care to ensure that the new model is as compatible as possible with the old and when you first fire up the 64 you are running a machine which is configured as a Dragon 32.

This means that almost all existing software will run on the new model without modification. We believe that this was a very sensible move as it means that an extensive range of software is instantly available for the new version. All Dragon 32 Basic programs will function correctly, as will any machine code programs which are either self-contained or use complete ROM routines. Problems should only occur where the programmer has broken into a ROM routine in the middle (which is pretty unlikely). Dragon Data says there will be no problems with any of their own software and a quick check of a range of independent offerings did not reveal any difficulties.

## Using extra memory

Of course, at this point you may feel that you have been cheated if you have just paid out good money for 64K of memory, so where is it hiding?

To find the answer you simply enter EXEC as your first command after power-up, when the screen will blank for a couple of seconds, and then the start message will reappear, but now with a blue flashing cursor to indicate a change of mode. Trying PRINT MEM again now reveals that 41241 bytes are available, and if you now enter POKE 25,6:NEW (to delete all the graphics pages) and PRINT MEM again no less than 47385 bytes are at your command for your Basic programming.

To understand how these two modes are implemented, and more memory can be added to the Dragon, we need to consider a number of factors.

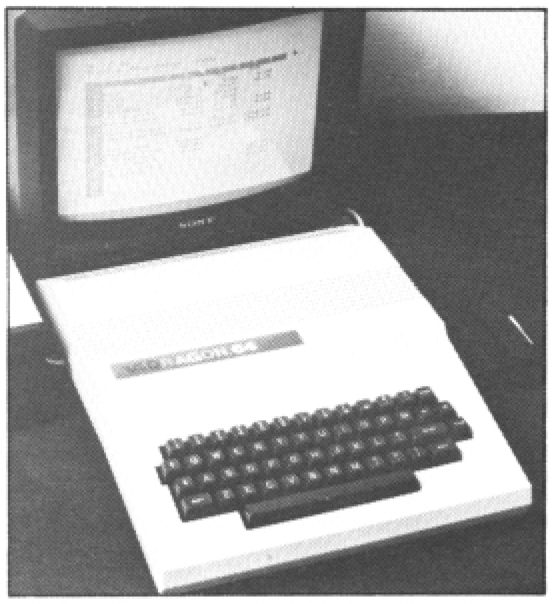
The first is that the SAM chip used in the Dragon can work in two modes known as map type 0 and map type 1. Map 0 will access 32K of RAM and map 1 64K of RAM. In map 0 RAM is accessed in the first 32K addresses and addresses 32768-49151 (&H8000-&HBFFF) and 49152-65279 (&HC000-&HFEFF) are available for the Basic interpreter and cartridge port, respectively. On the other hand in mode 1 only the 64K of RAM can be accessed, so you can have 64K of memory but nothing else!

The standard Dragon 32 can only operate in map 0 but the Dragon 64 can be switched between these two modes. Of course, if you want to run Basic in 64K mode you still have to use 16K of memory to hold the interpreter, so only 48K (less some bytes reserved for system use) will actually be available for program and variable use.

It is possible to expand the memory of the Dragon 32 to 64K of RAM and 'unofficial' upgrades are commercially available (in fact certain early models were apparently shipped with 64K RAM inside but not accessed!).

However, simply adding more RAM does not solve all your problems.

The problem is that the interpreter was written by Microsoft in 'position dependent code' so that it must occupy the same memory addresses as before. If you follow this route you therefore now have 48K of memory available but it is split into 32K below Basic and 16K above it. This means that it is difficult to access the top portion for Basic programming, although it can be easily used for storing machine code. If you do not want to use Basic at all then you can simply configure to 64K of RAM and use the full memory for machine code programs, alternative languages etc.



*The 64 in action: more possibilities*

## Twin ROMs

How Dragon Data got round this difficulty is revealed by looking inside the 64, where you find that there are two 16K ROMs sitting side by side at the back. In the review machine these were 16K EPROMs but we understand that the final masked ROMs have now been produced.

One of these ROMs is essentially the same as that in the 32, and this is used in 32K mode. The second ROM contains a reassembly of the original source code for the interpreter at higher locations (49152-65279, &HC000-&HFEFF) (the original cartridge port area).

(If you are not familiar with the idea of 'position dependent' code then think about this simple Basic program which will keep printing a message.

```
10 PRINT "HELLO"
20 GOTO 10
```

If you change the line numbers by adding 100 to each and rewriting the lines then the program will crash as there is no longer a line 10.

```
110 PRINT "HELLO"
120 GOTO 10
```

On the other hand if you had used RENUM 100,10 on the original program the GOTO line number would also have been changed so the program would function correctly.

```
110 PRINT "HELLO"
120 GOTO 110
```

In effect the original Basic program was 'position dependent' as GOTO 10 referred to an ABSOLUTE line number. Using RENUM was rather equivalent to reassembly as not only the position of the lines but also the address of the jump in GOTO was changed.)

In the 'official' 64K version of the Dragon the Basic interpreter therefore sits at the top of memory with a continuous 48K available below it for programs and variables. Of course, using two ROMs must have increased the cost but it is a far more elegant solution than trying to patch two separate RAM areas together.

When you EXEC as your first command (or EXEC 48000 at any time) a new bootstrap routine in the 32K version ROM neatly swaps back and forth between map types 0 and 1 and copies the contents of the 64K version ROM into RAM (using the cassette buffer as a temporary store). Although the interpreter is in RAM it is non-volatile and pressing RESET will produce a 'warm-start' so that you remain in 64K mode.

As the interpreter is located in RAM it is possible to modify it (although of course you must take care not to crash the system). You can easily change the Basic keywords, so that the old ones are not recognised but only customised ver- ▶

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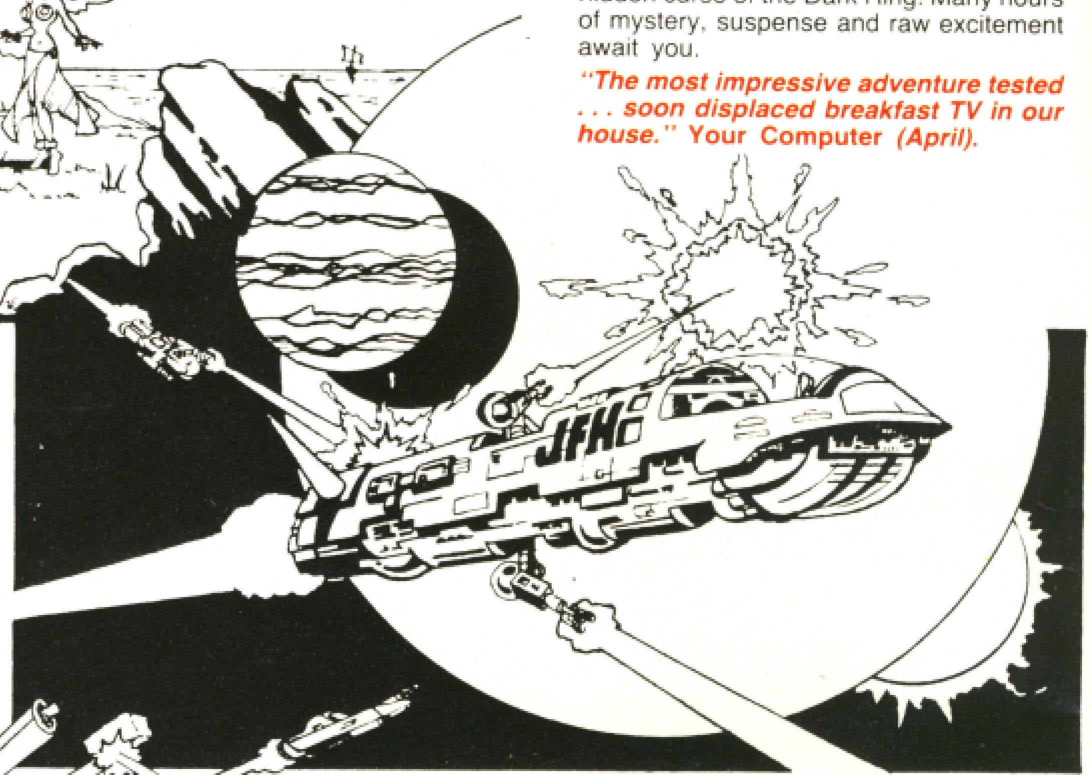
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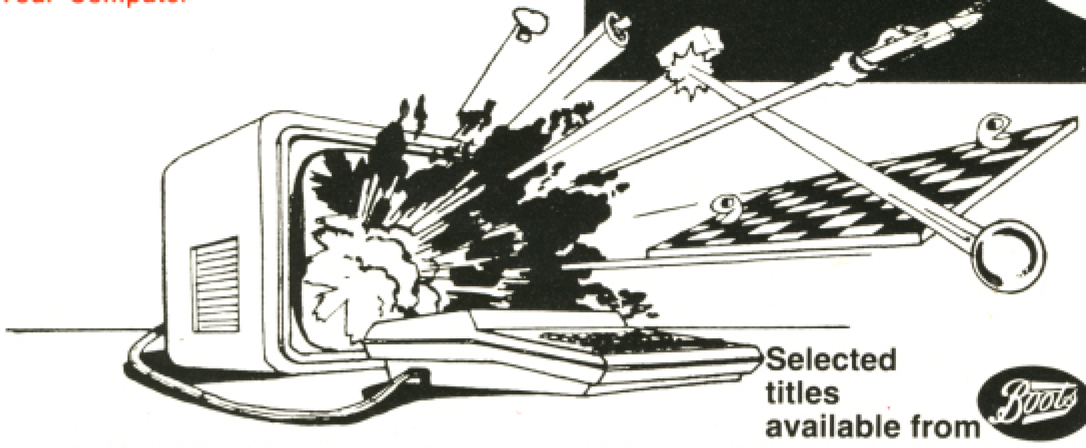
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◀ sions. For example, you could change NEW to NOW to prevent malicious fingers wiping your program by simply POKEing 49289 with the ASCII code for '0' (79). Once you have done this then NEW will only produce a syntax error but NOW will perform a NEW!

This modification will be retained unless you press the RESET button when a checksum routine will discover that the original Basic has been corrupted and recopy the official version back from ROM. (This is a safety device in case your program goes haywire and overwrites the Basic area.) When you switch from 32K to 64K mode the system does not perform a NEW but rather a CLEAR and therefore any program located in the bottom 32K of RAM will be preserved.

## RS232 interface

The serial RS232 interface is hardware implemented through a 6551 Asynchronous Communication Interface Adaptor. This is a very efficient method of transfer as the CPU loads a full byte at a time and can perform other tasks whilst each bit is transmitted.

Two new Basic commands have been added to download ASCII format Basic programs (DLOAD) and machine code files (DLOADM) from a host computer. These function like CLOAD and CLOADM with parameters being optional. The baud rate can be specified at one of seven preset rates (110-9600) with the 'baud rate select' parameter, or set with a POKE command to any of 16 rates (50-19200). The serial data is transmitted and received as one start bit, eight data bits, two stop bits, and no parity bit. The RS232 interface can be manipulated directly from Basic by PEEKing and POKEing the appropriate registers in the 6551 and a brief explanation of how to input and output a character is given.

Although the original parallel I/O port is retained as the default device used by the PRINT#−2 and LIST commands this position can easily be changed and the RS232 interface used to feed serial printers instead by POKE&H3FF,1. Since both serial and parallel printers are now supported it is a mystery why Dragon Data has redesignated the 'P I/O' port as 'PRINTER'!

## Auto-repeat

A keyboard auto-repeat facility has been added in 64K mode, and the delay is easily modified by POKEing RAM at &H11F. This feature has not been included in the 32K ROM, to avoid incompatibilities with existing software, but details are given on how it can easily be added.

Our impression was that the keyboard scan was better with autorepeat enabled so that rapidly pressing keys on the same row did not cause missed characters as sometimes happens on the 32.

The bug in the original 32 ROM which cause all USR calls to be treated as USR0, unless they were preceded by a zero, has been corrected in both modes. In addition the MEM and VARPTR functions have been altered so that they treat their 16-bit result as an unsigned number and therefore do not return negative numbers for values over 32767.

## Documentation

First of all the 165-page book 'An Introduction to Basic programming using the Dragon' by Richard Wadman, which was originally produced for the 32, is included. We feel that this is probably about average for the standard of manuals produced by most home micro manufacturers, now that it has been thoroughly debugged, although that is rather a back-handed compliment.

Secondly, there is a very thin 8-page "Dragon 64 Supplement" which briefly explains the additional features, and gives the memory map in 64K mode. Regular readers will know that adequate documentation is one of our hobbyhorses but we regret that we feel that the information provided with the 64 is rather inadequate and undoubtedly its weakest point.

## You can't win them all

The main disadvantage of moving to 64K mode is that RAM now overlays the cartridge port area so that this cannot be accessed. This means that you cannot operate your disk system (Dragondos or Delta), or use cartridge utilities, in this mode. Of course, you can load a program from disk in 32K mode and then switch to 64K mode to RUN it.

Although moving up to 64K mode is simple it is not so easy to switch back to 32K mode as no 'reverse bootstrap' is provided and all the Basic pointers must be restored (but no doubt it will not be long before someone provides the answer to that one).

Cassette operations are exactly the same in 64K mode as in 32K mode.

## Conclusions

Will you still need me — when I'm 64? (with apologies to Lennon and McCartney).

Dragon Data is following a policy of vertical development where each new product produces a more 'complete' computer system. The Dragon 64 has been particularly designed as part of a system to appeal to the small business sector where a package containing the Dragon 64, Dragondos disk system, and the OS-9 operating system is to be offered at a very competitive price, around £500. A major reason for the arrival of the 64 is that 64K of memory are needed to run OS-9.

Of course, success will depend upon the availability of suitable business packages, but Dragon also seems to have that side of things well in hand. Impressive trans-Atlantic word processor and spreadsheet programs running under OS-9 were on display on the Dragon Data stand at the recent PCW show and we understand that these are to be offered at very competitive prices (around £60) in the belief that wider sales are a better way to recoup the heavy costs of the licences than a small volume of high-priced sales. Only time will tell if this move into the business area will be successful but we feel that the machine itself should stand up to the hammering it is likely to get in continuous use.

Our own faithful 32 is now 15 months old and, apart from all its others uses, it has withstood being used as a wordprocessor for something like a quarter of a million words without a murmur of complaint.

To the home computer user having 'more' memory tends to be a question of "keeping up with the Joneses'" or is seen as some sort of 'virility' factor but you should really ask yourself how much memory you really need to run decent programs?

We understand that Dragon Data will continue to manufacture the Dragon 32 and that the Dragon 64 is an addition and not a replacement. It costs some £50 more than the Dragon 32 and if you are a new user trying to decide between them then you must ask yourself how far you intend to ultimately expand your system. If your requirements are for a games machine with perhaps a little serious stuff thrown in then you are probably better off buying a 32 and spending your money on software.

On the other hand if you want to keep your options open, and the extra cash will not break the bank, then you are better opting for the 64 as the facilities allow access to a much wider range of computing possibilities.

If you already have a 32 and your horizons are expanding then the decision is more difficult as you must carefully consider the alternative methods of expansion.

If an RS232 port is your major interest then an add-on cartridge providing this facility for the 32 is available from Cotswold Computers.

Microcare already offers 64K upgrades for the 32, the price of which varies with the particular board type used in your Dragon. Where 64K chips were originally fitted to the Dragon 32 they were only sold by the chip manufacturers as 32K as one half had failed quality control tests. In practice it appears that many of these will actually work effectively as 64K, to the standards required here, and some simple wire links will therefore produce very cheap memory expansion.

Disadvantages of this approach are that you can only run Basic if you produce a tape copy and reload it into its original location, and you may be plagued by mysterious crashes if odd RAM chips are duff.

## Dragon's alternatives

Dragon Data itself looked at two alternatives. The first is to provide an add-on board with another 32K of RAM. This would need to use tape-based Basic like the 'unofficial' upgrades but at least this could be a copy of the 'new' ROM which would be located at the top of memory.

The alternative under consideration is a complete main board swap to effectively produce a real 64. The disadvantage with this approach is that the only parts of the 32 remaining will be the keyboard, power supply and top half of the casing, so it will certainly not be cheap! A figure of £100 has been mentioned and if that is correct we feel that Dragon Data would be better off making some 'trade-in' and 'discount' offer to Dragon 32 owners than getting bogged down in large numbers of labour-intensive upgrades which can hardly be cost-effective. ■

# It's time to have words with your Dragon 32

*Tired of games? Want to give your micro a serious job? **Jim Dawson** shows how – by turning your Dragon into a word processor*

IT TAKES TIME, a long time, but one can write one's own word processor program for the Dragon 32. Basic runs fast enough to keep up with most typing, and though it uses up a lot of memory the Dragon still has enough left over for a decent sized text file. But Basic does fail badly when it comes to operations, like moving chunks of text around, that require a lot of PEEK-MODIFY-POKE sequences. This article presents three machine code subroutines which circumvent the main bottlenecks in editing.

There is also likely to be a speed problem in Basic print routines, and so a subsequent article will present a 1K machine code subroutine which offers a preprint line count, right justification with proportional spacing (even of mixed character format lines), some Greek letters ($\alpha$, $\beta$, $\gamma$, $\delta$, $\pi$ and $\mu$), centred lines and overlining (eg ABORT). Inasmuch as these facilities depend upon the printer obeying the command sequences, ESC J n for paper feed and ESC K $n_1$ $n_2$ . . . to enter dot matrix mode, they may be regarded as dedicated to the Epson MX80 family and similarly commanded printers.

```
                    BLOCK MOVE & WIPE ROUTINES

 0  8E 0 0      BMOV LDX   #n           POKE Source
 3  10 8E 0 0        LDY   #n           POKE Destination
 7  C6 0             LDB   #n           POKE Mode

 9  86 A0            LDA   #&B10100000  "Y+" Postbyte
11  54               LSRB               Test Mode Bit 0
12  24 D             BCC   MOVE         He wants Block Move not Wipe

14  A7 8C 35         STA   53,PC        Set the Instruction Postbyte
17  86 84            LDA   #&B10000100  "X" Postbyte
19  A7 8C 2E         STA   46,PC        Set Fixed Source Postbyte
22  30 8C E9         LEAX  -23,PC       Make X point to S Lo Byte
25  20 16            BR    NUMB         Go and make the Wipe

27  54          MOVE LSRB               Test Mode Bit 1
28  24 4             BCC   DMDE         Inc Dest wanted
30  86 A2            LDA   #&B10100010  Change to "-Y" Postbyte
32  31 21            LEAY  1,Y          and Pre-increment Y
34  A7 8C 21    DMDE STA   33,PC        Set the Instruction Postbyte

37  86 80            LDA   #&B10000000  "X+" Postbyte
39  54               LSRB               Test Mode Bit 2
40  24 4             BCC   SMDE         Inc Source wanted
42  86 82            LDA   #&B10000010  Change to "-X" Postbyte
44  30 1             LEAX  1,X          and Pre-increment X
46  A7 8C 13    SMDE STA   19,PC        Set the Instruction Postbyte

49  CC 0 0      NUMB LDD   #n           POKE N:  Number to be done
52  A7 8C 4          STA   4,PC         Save Hi Byte of N
55  5D               TSTB               Lo Byte Zero ?
56  26 9             BNE   LOOP         No

58  86 0        N Hi LDA   #n           Is Counter Hi Byte 0 yet ?
60  26 1             BNE   CONT         No.  Do another 256 moves
62  39               RTS                Yes.  Return to BASIC

63  4A          CONT DECA
64  A7 8C F8         STA   -8,PC        Reset Counter Hi Byte
67  A6 80       LOOP LDA   ,X+          or "X" or "-X"
69  A7 A0            STA   ,Y+          or "-Y"
71  5A               DECB
72  26 F9            BNE   LOOP         Repeat till B=0
74  20 EE            BR    N Hi         Then see if still more needed
```

*Program M1: carries out a variety of BLOCK/MOVE or BLOCK/WIPE functions*

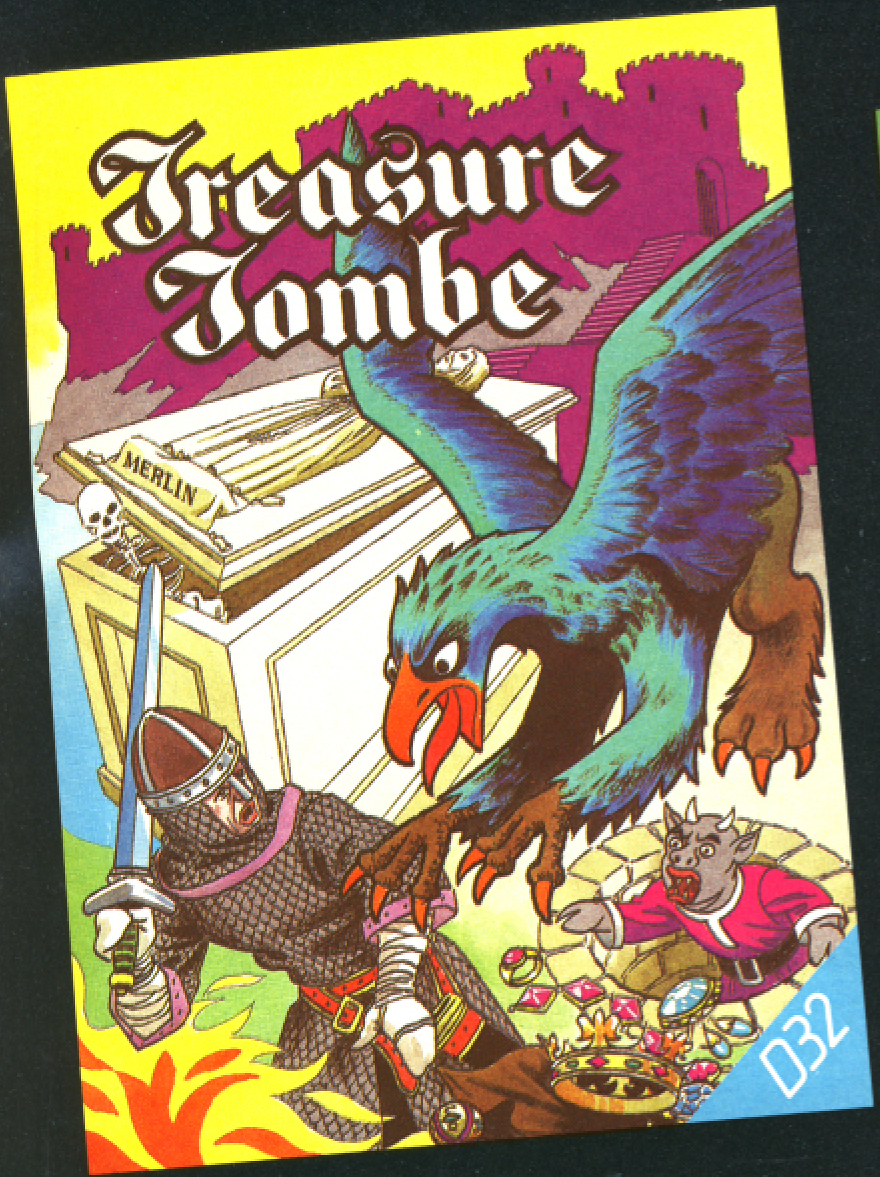
## Print routine

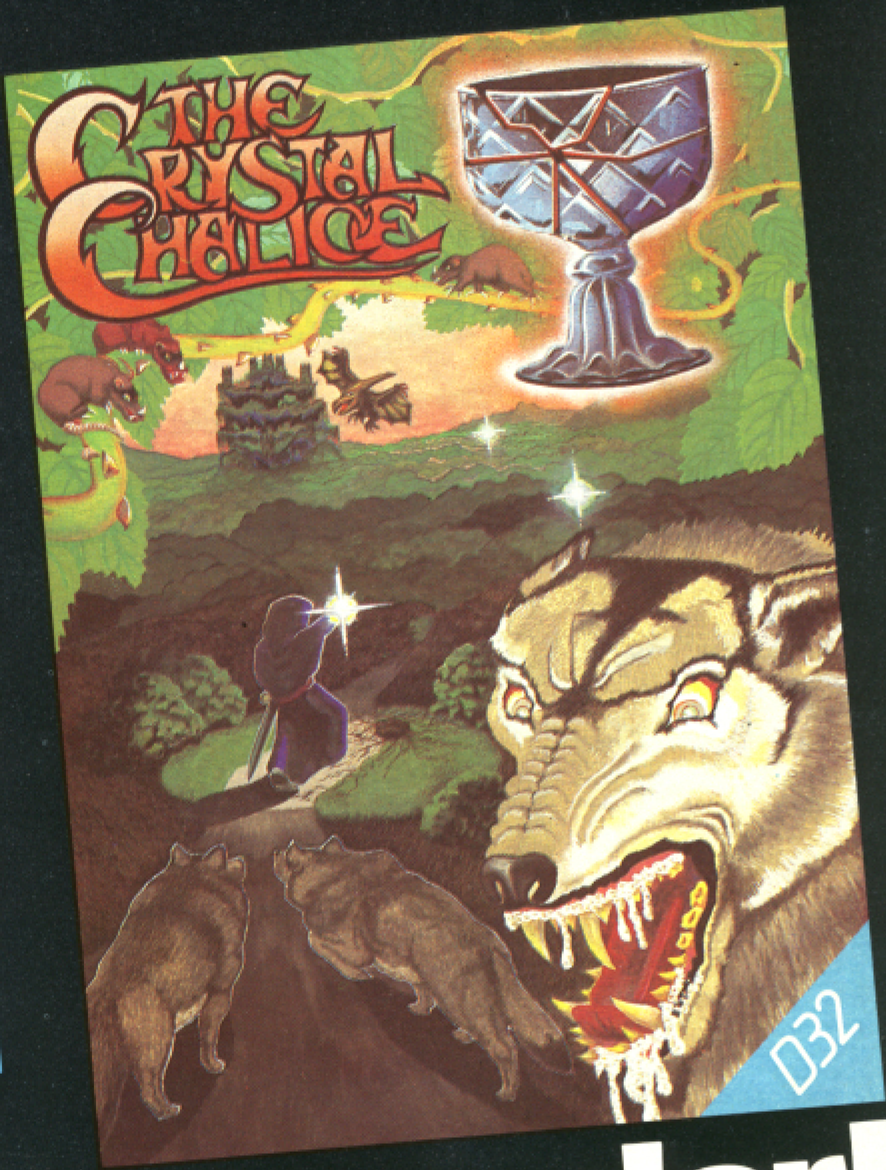
The print routine generates all implicit CR and LF commands and anticipates that character format commands, like HT, ESC W 1 (double width), ESC S 1 (subscript) etc will be encountered in the body of the text. The print routine also expects that there will be a text file header consisting (sequentially) of: the left margin, 11 other horizontal tab settings, nul, the right margin, the line spacing code, and the line count (hi and lo bytes). In the author's program this header starts at 19967 and the text file runs upwards from 20000. They are always saved together on tape as if they made up a machine code program — no attempt being made to use the file commands of Basic.

The machine code routines are all inherently relocatable and may be loaded from Basic by a "Poke &H Data" loop into any reserved part of memory (such as graphics page 1: 1536-3071). If the initial addresses given to the routines are known to Basic as M1, M2 . . . then their calling can also become position independent.

## Enter M1

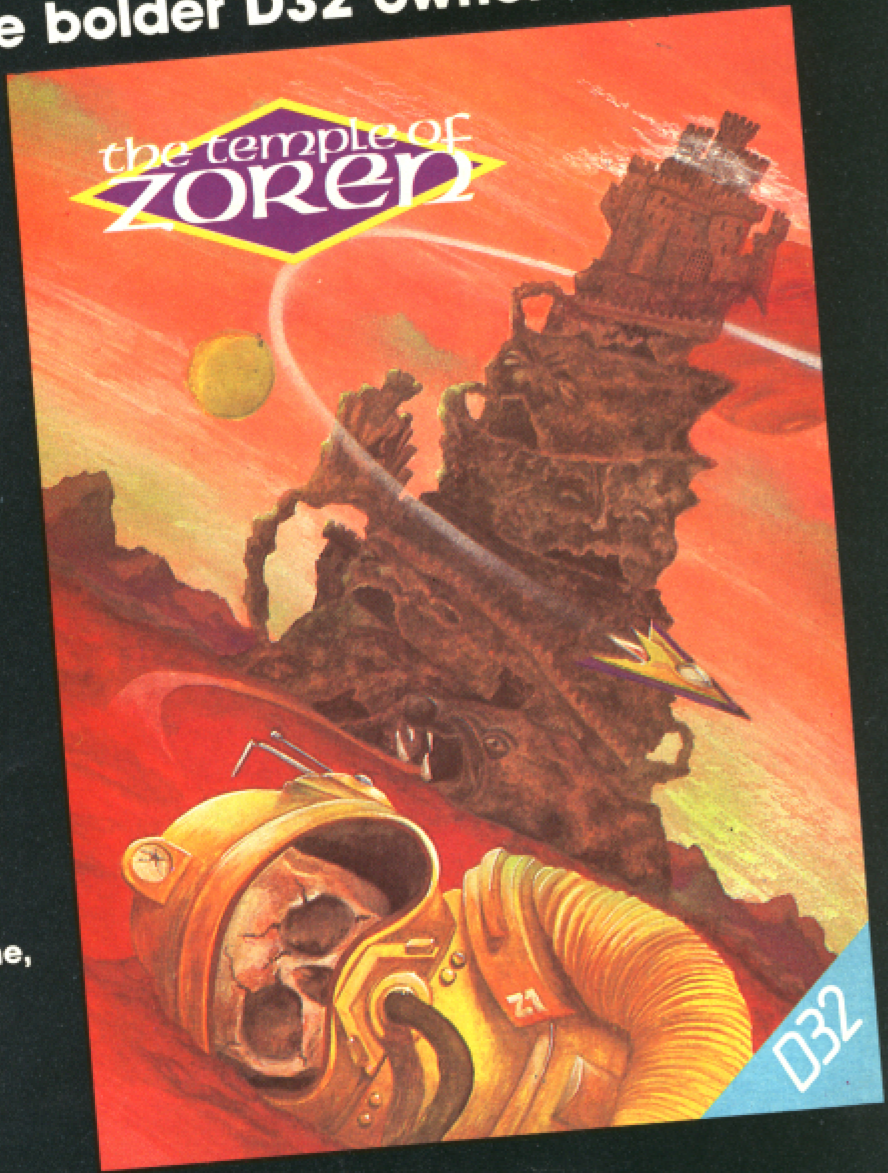
The first routine, call it M1, carries out a variety of BLOCK MOVE or BLOCK WIPE functions. Before being called it requires four parameters to be poked into it, but as they are not destroyed the routine can be called again with only the changed parameters re-poked. ▶




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◀ For a block move it needs to know the initial source address S, the initial destination address D, the number of bytes to be moved N (zero OK, but don't try negative), and a command byte M which controls the manner in which the moves are made. If bit 1 (ie $2^1$) of the control byte is clear the destination address will increment as the move progresses. If it is set (M = 2) the destination address will decrement. Bit 2 has a similar effect on the source address and the effect of these two control bits is additive, so that M = 6 will produce a block move with both the source and destination addresses working their way downwards. [The pre-decrement effect inherent in such machine code operations is hidden so that the moves appear to Basic to go with post-decrementing.]

If bit 0 of the Mode byte is set, so that M is any odd number, then a block wipe of the character defined as S (0 to 255) occurs N times to the incrementing destination D.

## Nice effects

As well as carrying out all sorts of rapid rearrangements of the text file this subroutine may also be used to produce some nice effects on the TV text screen (addresses 1024-1535) — for example, block wipes of red (S = 191) may be used to indicate erased sections of text, and block moves with S and D differing by just 1 may be used to shuffle sections of text or messages left or right.

Note that S, D and N are 16-bit numbers, requiring hi or lo byte pokes. In Basic you need something like:

```
10 X = S : Y = M1+ 1 : GOSUB90: X = D:
   Y = M1 + 5: GOSUB90: X = N : Y =
   M1 + 50 : GOSUB90: POKE M1 +
   8,M: EXEC M1
90 H = FIX(X/256): POKE Y,H: POKE Y
   + 1, X − 256*H: RETURN 'POKE Y,X
```

## Second routine

The second machine code routine, M2, is used to FIND the whereabouts in memory of a sequence of bytes which have been defined as the contents of F$. The routine needs three parameters: the first and last addresses of the section of memory which is to be searched, and a clue from Basic as to what it means by F$. For example:

```
50 X = VARPTR (F$) : Y = M2 + 1 :
   GOSUB90: X = START ADDRESS: Y
   = M2 + 14: GOSUB90: X = FINAL
   ADDRESS: Y = M2 + 19: GOSUB90:
   EXEC M2: ADDRESS FOUND =
   256*PEEK (M2 + 14) + PEEK (M2 +
   15)
```

If the search failed then the result obtained as ADDRESS FOUND will be one greater than the specified FINAL ADDRESS.

The routine assumes that the caller doesn't want to be told if the specified START ADDRESS itself corresponds to an occurrence of F$. It therefore starts its searching procedures from one address higher up. This makes life easier during multiple occurrence searches: since the routine returns its answer through the same memory location as is used to specify starting address, searches for ▶

```
                          FIND ROUTINE

 0  BE 0 0     FIND LDX   #n      POKE VARPTR(F$)
 3  EC 81           LDD   ,X++    A = Length of F$
 5  A7 8C 1E        STA   30,PC
 8  27 24           BEQ   NOF$    There is no F$ !
10  10 AE 81        LDY   ,X++    Address of Initial String Character
13  BE 0 0          LDX   #n      POKE Init File Addr/PEEK Address Found
16  30 1            LEAX  1,X     Skip immediate beginning of File
18  BC 0 0     NEXT CMPX  #n      POKE Final Address of File
21  22 14           BHI   EXIT    Search Failed
23  A6 80           LDA   ,X+     Next Character in File
25  A1 A4           CMPA  ,Y      Do Initial Characters Match ?
27  26 F5           BNE   NEXT    No
29  5F              CLRB          Reset Character Counter
30  A6 85      LOOP LDA   B,X     Next Character in File
32  5C              INCB
33  A1 A5           CMPA  B,Y     Do Subsequent Characters Match ?
35  27 F9           BEQ   LOOP    Yes
37  C1 0            CMPB  #n      Matching >= Length of String ?
39  25 E9           BLO   NEXT    No.  Search the File further
41  30 1F           LEAX  -1,X    Reset X to Address of Match
43  AF 8C E0   EXIT STX   -32,PC  Return Answer via Init Address
46  39         NOF$ RTS           Return to BASIC
```

*Program M2: used to FIND the whereabouts in memory of a sequence of bytes*

```
              TV TEXT DUMP WITH CONTROL CODE SUPPRESSION

  0  10 8E 0 0   TV   LDY   #n      POKE Source Address
  4  8E 4 0           LDX   #1024   TV Top LHC
  7  33 8C 47         LEAU  71,PC   All inverse except Capitals
 10  C6 0             LDB   #n      POKE Mode:  0, 1 or 2
 12  27 2             BEQ   %100    He wants the inverse display
 14  33 4B            LEAU  11,U    Change to UpC Blk on Grn display
 16  5A          %100 DECB          Shall I blank Control Codes ?
 17  27 2             BEQ   %110    No
 19  C6 20            LDB   #32     ASCII Suppression Threshold
 21  E7 8C 3     %110 STB   3,PC    Set Comparison Data Byte

 24  A6 A0       %120 LDA   ,Y+     Next character
 26  81 0             CMPA  #n      Is Char > Blanking Threshold ?
 28  24 29            BHS   %140    Yes - Skip code suppression

 30  1F 89            TFR   A,B     Save Control Code
 32  86 20            LDA   #32     ASCII Space
 34  AD C4            JSR   ,U      Convert ASCII to DRAGON Disp Code
 36  C1 1B            CMPB  #27     Is an ESC Sequence coming ?
 38  26 21            BNE   %150    No:  One Byte codes: CR, HT etc

 40  A7 80            STA   ,X+     Dump "ESC" on TV
 42  E6 A0            LDB   ,Y+     Main ESC Sequence Character
 44  C1 2B            CMPB  #43     Overline ?
 46  27 12            BEQ   %130    Yes
 48  C1 2D            CMPB  #45     Underline ?
 50  27 E             BEQ   %130    Yes
 52  C4 DF            ANDB  #&B11011111  Approx L to U Case Conv
 54  C1 52            CMPB  #82     R ?
 56  2D F             BLT   %150    Treat A-Q as 2 Byte Commands
 58  C1 54            CMPB  #84     T ?
 60  27 B             BEQ   %150    Yes - 2 Byte
 62  C1 57            CMPB  #87     W ?
 64  2E 7             BGT   %150    Treat X-Z as 2 Byte
 66  6D A0       %130 TST   ,Y+     3rd Byte of 3 Byte Sequence
 68  A7 80            STA   ,X+     Dump on TV
 70  8C               DATA  &H8C    Sneaky "BR %150"

 71  AD C4       %140 JSR   ,U      Convert ASCII to DRAGON Disp Code
 73  A7 80       %150 STA   ,X+     Dump on TV
 75. 8C 5 E0          CMPX  #1504   Have I got to TV bottom LHC yet ?
 78  2D C8            BLT   %120    No.  Go and do some more.
 80  39               RTS           All done.  Return to BASIC

 81  81 40            CMPA  #64     Only Capitals as Blk on Grn
 83  27 4             BEQ   %160
 85  81 5B            CMPA  #91
 87  2D 2             BLT   %170
 89  84 1F       %160 ANDA  #&B00011111
 91  39          %170 RTS

 92  81 20            CMPA  #32     Only Control Codes as Grn on Blk
 94  2D 8             BLT   %190
 96  81 60            CMPA  #96
 98  2D 2             BLT   %180
100  80 20            SUBA  #32
102  8A 40       %180 ORA   #&B01000000
104  39          %190 RTS
```

*Program M3: dumps 480 bytes from a test file on to the TV screen*

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◀ further occurrences of F$ can be carried out by more EXECs without the need for any more POKEs.

## Sneaky tricks

If preferred, the pre-increment can be removed by substituting two NOPS (HEX12) for the two bytes (HEX 30 & 1) of LEAX 1,X operation. As well as its obvious use from the word processor point of view, this routine also comes in handy in the sneaky tricks department for finding out where specific sequences are hidden in memory — parts of program lines for example.

Bear in mind that the routine may hit upon F$ both on the TV text page and also in the string storage region. Specifying 65535 as the final address for the search is unwise, but the routine will always be saved from going into an infinite loop by the fact that it must at least find F$ at the place where it is defined. If F$="" the routine will return to Basic without doing anything.

## TV screen dump

The third routine, M3, takes the next 480 bytes from an upward going text file and dumps them on to the top 15 lines of the TV screen, leaving the bottom line free for editing messages.

The starting address must be poked into M3 + 2 by a 16-bit poke and again there is a mode byte, to be poked into M3 + 11.

Mode 1 dumps any character above ASCII code 31 on to the TV as black lettering on a green background. Only ASCII control codes 0-31 appear as indirectly related inverse video characters: green on black. It very soon becomes familiar that inverse "MMI" means "CR, CR, HT"!

Mode 2 is similar except that single character commands, like CR, all two-byte ESC sequences and the three-byte sequences "ESC +/−/R/S/U/V/W n" are all blanked and appear as if they had been "space" characters.



*The Dragon: your own word processor*

In that respect Mode 0 is similar to Mode 2, but it makes everything else except capital letters appear in inverse video. Mode 0 is thus similar to the Dragon's normal method of distinguishing between upper and lower case letters except that for ease upon the eyes all non-capital characters (figures, punctuation, spaces etc) are also rendered as green upon black.

These routines give a direct mapping; no attempt is made to obey command characters. Having words wrap around the screen isn't ideal, but one gets used to it, and it has the distinct advantage that the direct text file to screen position correspondence greatly eases the writing of the cursor moving and editing routines.

## Various hints

Finally, a few more suggestions, or hints, for a word processor. Start by writing a main menu with choices such as to edit, print, save on tape etc. Then concentrate on making a flashing cursor and poking it around the TV screen (and nowhere else!!!).

Use INKEY$ to test for single letter commands like the arrow keys, "a" for advance, "−21a" for go back 21 lines etc.

Decide how to insert new text into the file — either split the file at the required point and poke new text (via INKEY$) into the gap, or poke the new text into a buffer (eg downwards from 32767) and make the split and block insert later.

In the insert or writing mode use the CLEAR key (A$ = INKEY$: IF A$ = CHR$(12) THEN . . .) to define that the next key pressed will be a command not text. Then get other edit commands to work, like deletions, block saves, "5c" for change the next five characters, "f . . . CLEAR" for "Find . . .".

Perhaps then it will be time to think about printing, but there will still be more to be done with editing — like adding the ability to set up multiple automatic command strings: 100 (Find "1983", Delete, Insert "1984") etc. ■

# New man in the driver's seat



***Graham Cunningham** talks to Dragon's new managing director, Brian Moore*

ONE DAY YOU'RE browsing through the news-stands looking at microcomputer magazines, including *Dragon User*; next thing you know you're managing director of Dragon Data. It couldn't happen to you or me — but it did happen to Brian Moore, who has moved from electronics giant GEC to take over the running of Dragon Data.

But Brian is keen to point out that his appointment does not mean any changes of direction at Dragon Data. The company is still keen both to move upwards in the micro market and to consolidate its position as a leading home computer manufacturer. This means that a Dragon 128 (a working title) is under development, along with a new home computer to maintain the company's attack on the market in which it began.

## Upgrade service

Brian is particularly impressed by the affection many owners have for their Dragons. He intends to repay this affection by being "far more active in terms of our relationship with Dragon users". As part of this he recognises the need to provide an upgrade service for 32 owners and plans to offer various packages enabling this at the beginning of next year, if not earlier.

He also thinks that there is a "reasonable future for the 32, particularly overseas". As well as "keeping the installed base serviced" (including plans for lots of new software) he intends to spread that base by launching new machines, beginning with the 64 which he describes as "a powerful home computer and ideal small business machine".

The arrival of OS-9 operating system on the 64 is regarded as particularly important. "It will make the 64 a very powerful machine indeed," comments Brian. The 64 will then be capable of handling tasks ranging from basics such as word processing to advanced applications such as electronic mail — with more than one task being handled at once. Multi-tasking is the major advantage OS-9 has over Flex, the other main operating system for 6809-based machines. Its major disadvantage is that more applications software is available for Flex. However, Dragon Data argues that though this is the case at the moment, "OS-9 software will catch up with Flex".

This move into business machines involves a marketing change for the company as it will be appealing to a different range of users. Business buyers are more likely to approach dealers than the large chain stores such as Boots which is responsible for the bulk of 32 sales. So one of Brian's other priorities is "to establish very good relationships with dealers".

Brian is particularly pleased that the 64 is software compatible with the 32. As he puts it: "We like to support our users" — and the decision simplifies retailing for both machines and their software. Similarly software in Basic 09, which arrives with the OS-9 system, is planned to be compatible with the 128.

## Exciting future

Further beyond the 64 Brian prefers not to commit himself at the moment — but talk of machines which Dragon Data itself could use for administration and an interest in pictorial menu systems such as Apple's Lisa indicate the excitement with which he views the future.

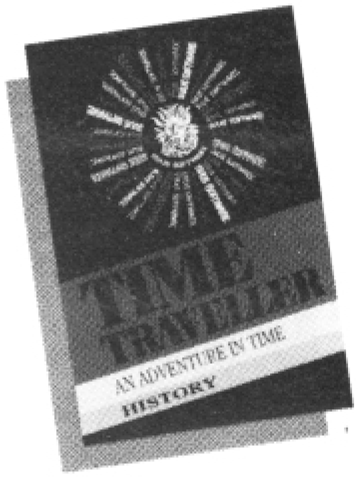
Brian's reluctance to discuss the 128 in detail is based partly on the argument that the more he says about it, the more competitors will know. Doubtless another reason is that talk of future projects draws attention away from the already available Dragon — although any wise micro buyer is likely to go for an already established machine which has overcome any initial bugs and has had a good base of software developed for it.

On the subject of the micro industry as a whole and Dragon Data's position in it, Brian is forthcoming. He thinks that the company is a "real nice business" and enjoys "dealing on a day-to-day basis with up-to-date technology". He finds the industry itself exciting too — the challenge of beating the competition which is trying to do the same to you. Staying at least one jump ahead is the name of the game, although as Brian points out, deciding what exactly you have to stay ahead of can be as difficult as doing so.

The competition may be "a moving base" but you have also to distinguish between "actual and perceived rivals". As he says: "Too often it's only in the small print in advertisements that you find out when something is actually going to be available." Dragon Data's desire to tie in publicity with availability, and to have room to improve on rival developments, are other reasons for Brian's reticence on new products.

The question of when a rival product will be available in quantity is of crucial importance to a company such as Dragon Data. For example, Brian admits that the Electron will be a strong rival to the Dragon 32 — how strong depends on the number of Electrons Acorn can get to the market. Similarly if demand exceeds the supply of Commodore's 64 then the Dragon 64 should benefit. ▶

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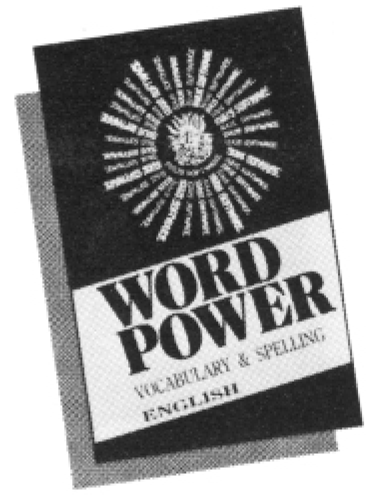

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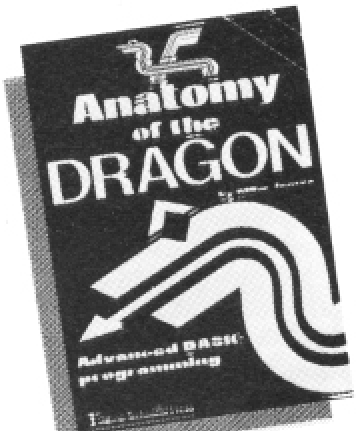
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◀ As Brian points out, both Sinclair and Oric have declared their intentions of moving upmarket — so the competition will be equally fierce for the 128. All this while companies such as Commodore and the giant IBM have made a success of moving down. In fact IBM's PC Junior (codenamed Peanut) will be a major rival — when it is available. Brian's opinion is that IBM is likely to delay launching this machine in the UK until demand for its PC has quietened down. He adds: "IBM is very good at marketing, so I'm sure they'll pick the right moment." When they do pick their moment there is no doubt that the PC Junior will sell, regardless of its technical merit. At a time when the list of injuries in the micro industry is growing ever longer, the appeal of IBM's solidity will be even stronger. This list already includes Grundy, Jupiter, Atari, Texas Instruments and Mattel — and some observers attempted to add Dragon Data earlier this year.

In September a £2.5 million investment package was announced for the company. At the time it was admitted that summer sales had fallen short of predictions, putting "strains on Dragon Data's immediate cash and borrowing facilities" according to a shareholders' statement at the time. The link between a bad summer and the need for more money coloured reaction to the £2.5 million announcement, so that some people interpreted it as a rescue package. However Dragon Data argued: "Although the fall-off in demand emphasised for us the seasonal nature of this industry, the encouraging aspect was that Dragon held on to its overall market share." The company also thought that a request for capital was natural at that stage of its development, so the £2.5 million was an investment boost allowing it to gear up for the pre-Christmas sales period.

At the time Dragon Data's shareholders also announced that former managing director Tony Clarke "had previously indicated to the board that he wished to resign for personal reasons". Dragon Data's main shareholder is Prutech, the high technology investment division of Prudential Insurance, which is a shareholder in GEC. The board invited to GEC to provide one of its senior executives as Dragon Data's new managing director — and Brian took over on September 12.

## Optimistic view

He is emphatic that the £2.5 million was an investment boost ("more than enough," he comments) and that the company's cash-flow problems were "very simple and overplayed by the press". He thinks that Dragon Data is "a very successful business" and expects a turnover of £18 to £20 million for the company's first year of operation. As he points out this is very "ambitious growth — the company has come from nowhere to be a leading home computer manufacturer in less than a year".

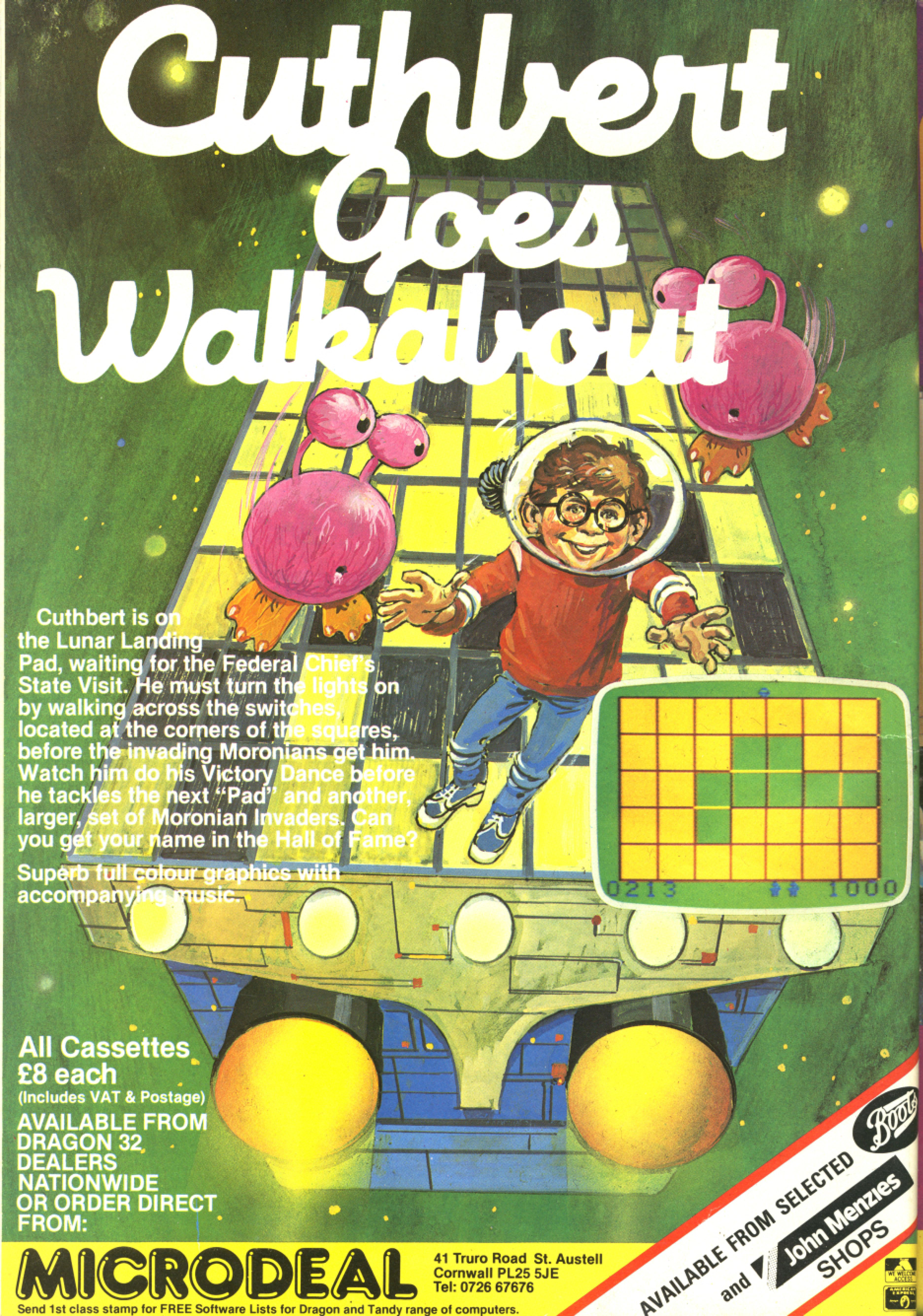
He continues: "The order book is full and we despatch everything we build." The company has already sold all the Dragon 64s it can produce for Christmas and Brian thinks the machine has been "very well received in the US".

Before moving to Dragon Data Brian was deputy managing director of a GEC subsidiary specialising in microprocessor-controlled heating and ventilation systems. He has a wide range of experience including engineering, financial management and business applications for computers. He explains that GEC is more a "collection of companies", much more decentralised than firms such as IBM, so he's used to operating "without a cushion". Dragon Data is "much younger and the industry faster-moving" than his previous experience, but "certain things are basic to every business". On the technical side he knows "enough to listen to what people tell me" and thinks that his lack of advanced expertise is a distinct advantage". As he explains: "You need to keep basic business objectives in mind and react fast, rather than keeping your head in the computer box."

Brian is fascinated by the speed with which the micro industry is moving. Talking just six weeks into his new job, he says with relish: "I feel as though I've been here for years, not just because things move so quickly but in terms of the amount I've covered." Brian's not sure how long he will be with Dragon Data (officially he's on "temporary secondment" from GEC), but expects to be there a minimum of six months and has "no plans to leave in the foreseeable future". In that six months he will have acquired a great deal of experience — particularly if that sense of "time distortion" continues. ■



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# Set up your own chain reaction

***Pam D'Arcy** introduces Chains, a word game to beat the graphics blues*

BEING THOROUGHLY DISGRUNTLED with the apparent bugs in many Dragon graphics programs featured in magazines, I have produced this word game for my family and fellow graphics sufferers. It is based on a card game I played just once as a child, but which made a lasting impression on me. The game consisted of a pack of cards bearing names of railway stations and was a form of dominoes — you added to the last station card played if you could match its last letter(s) with the first letter(s) of one of your station cards. Chains follows that idea, except that it limits the matching overlap to a maximum of two letters.

In order to minimise coding and hence typing agonies I have deliberately omitted vast numbers of possible error checks on the input/detailed instructions/input options through the screen (after all, you can always add to the program if necessary). There are some minor operational points that you can similarly improve upon. The REM statements can all be omitted, too. I have deliberately avoided GOTOs/GOSUBs to those lines for that reason.

```
9000 DATA ADVENTURE,ADVANTAGE,ANGUISH,ALIEN,ANTHEM,ALLERGY,CHINA,CHAFE,EMBER,EMI
GRATE
9010 DATA ENGINE,ENVELOPE,ERASE,ERADICATE,EASY,EAST,FEMUR,FETCH,GYMNASIUM,GYPSY
9030 DATA GENEROUS,GENTLEMAN,HYENA,IDLE,IDEA,INANE,INCH,LANGUID,LEGALISE
9040 DATA NEBULA,NEAPOLITAN,NAIAD,NAPKIN,PERISH,PERENNIAL,RECIPE,READ,SERIOUS,SY
MPATHY
9050 DATA SYSTEM,SERUM,STRAFE,SHAGGY,STAID,SHEATH,THIMBLE,THRUST,TETCHY,TEA
9060 DATA USHER,USUAL,UMPIRE,UMBRELLA,URGE,URCHIN,LABOUR,LENGTH,****
```

*Figure 1: Data entry sample. The words are jumbled deliberately.*

Chains is a game for up to nine players (the computer can play, too) with a choice of playing from a maximum of six or nine words each. The computer initially distributes six or nine words (as instructed) to each player selected at random from the available DATA. A further word is then selected at random as the starting word and is displayed on the screen, along with the first player's list of words.

Players in turn select from their lists, numbered from left to right across the screen, to "chain" one of their words to the previous one played by matching its last one or two letters with the first one or two letters of a word in their list. If a player cannot go and currently holds a less than the maximum (six or nine) number of words, the computer adds a further word to that player's list for his/her next turn. (As the allocation is random, be prepared for a slight delay in response while the computer is hunting for the last one or two words still available for allocation.) If all players are unable to go and have full allocations of words or there are no more words left to be allocated, the game ends with a listing of the number of words still held by each players and the number of words each has played.

A "patience" version is possible ▶

```
10 REM CHAINS (C) PAM D'ARCY
20 REM              JUNE 1983
30 REM INITIALISE PROGRAM
40 GOTO 850
50 REM INITIALISE NEW PLAYERS
60 GOSUB 960
70 REM INITIALISE PLAYERS
80 GOSUB 1120
90 REM NEXT PLAYER'S TURN
100 IF NP=PTOT THEN NP=1 ELSE NP=NP+1
110 REM PRINT PLAYER'S WORDS
120 GOSUB 1300
130 IF PN$(NP)="MY TURN" THEN 700
140 REM EXTERNAL PLAYER
150 PRINT@448,"WHICH WORD (1-9)";: INPUT ITEM
160 IF ITEM >NW THEN 590
170 IF ITEM=0 THEN 430
180 THIS$=P$(NP,ITEM): FA$=LEFT$(THIS$,1): FB$=LEFT$(THIS$,2)
190 IF THIS$="" THEN 610
200 IF EA$<>FA$ AND EB$<>FB$ THEN 650
210 REM VALID
220 P$(NP,ITEM)=""
230 GOSUB 1430
240 REM CHAIN WORD
250 IF ITEM<4 THEN PRINT@(341+(ITEM*11)),BLANK$;: GOTO 280
260 IF ITEM<7 THEN PRINT@(340+(ITEM*11)),BLANK$;: GOTO 280
270 PRINT@(339+(ITEM*11)),BLANK$;
280 PRINT@342,THIS$;
290 GOSUB1480
300 PRINT@342,BLANK$;: PRINT@246,THIS$;
310 EA$=RIGHT$(THIS$,1): EB$=RIGHT$(THIS$,2): MLEN=LEN(THIS$)+1
320 WP(NP)=WP(NP)+1: WL(NP)=WL(NP)-1: LAST=0
330 IF WL(NP)<>0 THEN 100
```

◀ by pressing ENTER in response to the number of players prompt (the same can be achieved by entering "1" player, too).

To get the computer to play, enter "MY TURN" as the player's name. It is fascinating to sit back and watch the action after entering "MY TURN" for all nine names!

The game is as good as its DATA. I haven't included any DATA statements in the program listing as I feel, for entry purposes, it is easier to offer you a list, in English as it were, than have words split over printed lines. Figure 1 shows how easy it is to enter the DATA. I have deliberately presented the words in the lists in a jumbled fashion as a preponderance of "N" words seemed to regularly occur for one player when using alphabetic sequence. The program can cope with words up to 10 characters long (three per screen line).

I suggest that once you have typed in the program, it can be saved as the "master" and appropriate DATA sets be added, each program version being called something instantly recognisable.

## Inbuilt program flexibility

1 **Amount of DATA:** The program copes with a maximum of 100 words (lines 850-880 to increase this). Fewer than 100 words may be used by terminating the DATA with the string "****"

2 **Number of players:** The program automatically calculates the maximum permissible number of players (to a maximum of nine) according to the amount of DATA and maximum number of words (six or nine) each player is to be allocated.

3 **Number of words per player:** The variable "NW" as set up in line 920 detemines this (six or nine as required). It is an easy task to edit this line prior to RUN should you want a different version from the one you have saved (quicker than loading a different version, too!). Again, I could have made this an INPUT parameter, but wanted to minimise your code entry task. ■

**Words:** I spent more than a day devising/refining this set, so good luck to you if you can do better! Obviously, the fewer variations you have on word startings/endings, the greater the chances of a successful conclusion.

| | | | | |
|---|---|---|---|---|
| ADVENTURE | ADVANTAGE | ANGUISH | ALIEN | ALLERGY |
| CHINA | ENGINE | ENVELOPE | ERASE | NEAPOLITAN |
| THREAD | THERE | THETA | TIARA | YULETIDE |
| EASY | NAIAD | NAPKIN | NEUROTIC | PERISH |
| ERADICATE | EAST | FEMUR | FETCH | GENEROUS |
| RAFFLE | RESIN | RAG | STRAFE | SERIOUS |
| HUMOROUS | HALF | HEROIC | ICICLE | LIEU |
| USHER | USUAL | URGE | URCHIN | LABOUR |
| CHILLI | CHIMPANZEE | DECIDUOUS | DEPRESS | EEL |
| STAID | SHEET | THIMBLE | TETCHY | TEA |
| GENTLEMAN | HYENA | HYPHEN | IDLE | IDEA |
| EAGER | EAR | ERA | EARLY | EFFECT |
| PERENNIAL | RECIPE | READ | GLADE | LEECH |
| STEEL | STRING | STYLUS | EUROPE | ELEVEN |
| INANE | INCH | LANGUID | LEGALISE | YARDAGE |
| ENROLS | EVEREST | EYE | SPREAD | DEGREE |
| LENGTH | NATURAL | YACHT | YETI | RADIUS |
| RECOUP | YEAST | **** | (87 words plus end marker) | |

*Figure 2: An example DATA list simply using ordinary words.*

**Stations:** You've guessed it — the first set of DATA I produced! Compiled from BR's 1979/80 Passenger Timetable — but the difficulty is in arriving at a conclusion. Nevertheless, it is geographically interesting.

| | | | | |
|---|---|---|---|---|
| TENBY | CHEPSTOW | EYNSFORD | LEEDS | RYDE |
| AYR | INVERNESS | MARYLEBONE | HULL | ESHER |
| LONDON | KEW | REDCAR | YORK | SWANSEA |
| LIVERPOOL | DEAL | SOLIHULL | SIDCUP | YARMOUTH |
| HARROGATE | YEOVIL | WATCHET | YSTRAD | ERITH |
| OLDHAM | BYFLEET | RYE | RUGBY | WEYMOUTH |
| AMBLESIDE | LISKEARD | EWELL | FELIXSTOWE | SOUTHALL |
| DYMCHURCH | VENTNOR | PENZANCE | PELAW | EPSOM |
| CHARLBURY | NEWCASTLE | ALTRINCHAM | REDRUTH | ARUNDEL |
| KETTERING | LIMERICK | WORKSOP | GRIMSBY | SKEGNESS |
| MALLAIG | UPHOLLAND | KNEBWORTH | LLANDAFF | EGHAM |
| NAILSEA | ENFIELD | ARDLUI | NETLEY | NEWARK |
| EASTBOURNE | THORPE | GLOSSOP | GRAYS | DOLAU |
| TYSELEY | ETRURIA | WATERLOO | TONBRIDGE | LLANELLI |
| DUNDEE | KIDSGROVE | LYTHAM | ABERDEEN | ROCHDALE |
| ALDERSHOT | UPMINSTER | HOVE | KILMARNOCK | MAGHULL |
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| DERBY | THURSO | KENDAL | MANCHESTER | THIRSK |
| SHREWSBURY | DEVONPORT | STOKE | YATTON | EALING |
| PWLLHELI | HAYES | ROSSLARE | LEWES | EDINBURGH |

**** *(100 stations, but included for safety in case any are omitted during entry!)*

*Figure 3: An example DATA list using the names of British Rail stations.*

```
340 PRINT@384,"CONGRATULATIONS, YOU HAVE WON": PRINT
350 REM ANOTHER GAME PROCEDURE
360 PRINT@448,"WHAT NOW? QUIT(Q); SAME PLAYERS (Y); DIFFERENT PLAYERS(P)";
370 ITEM=RND(MAX): GA$=INKEY$: IF GA$="" THEN 370
380 IF GA$="Q" THEN CLS: END
390 IF GA$="Y" THEN 80
400 IF GA$="P" THEN 60
410 GOTO 370
420 REM CHECK FOR CHEATING!
430 FOR AA=1 TO NW
440 IF EA$=LEFT$(P$(NP,AA),1) OR EB$=LEFT$(P$(NP,AA),2) THEN 630
450 NEXT AA
460 REM CAN'T GO
470 IF CL=0 OR WL(NP)=NW THEN 570
480 REM GIVE PLAYER A NEW WORD
490 GOSUB 1530
500 WL(NP)=WL(NP)+1
510 FOR AA=1 TO NW
520 IF P$(NP,AA)<>"" THEN NEXT AA
530 P$(NP,AA)=THIS$
540 LAST=0
550 GOTO 100
560 REM NO NEW WORD CAN BE ALLOCATED
570 LAST=LAST+1: IF LAST=PTOT THEN 1580 ELSE 100
580 REM ERROR RESPONSES
```

**Continued on page 44**

# GAME TO EARN £1,000?



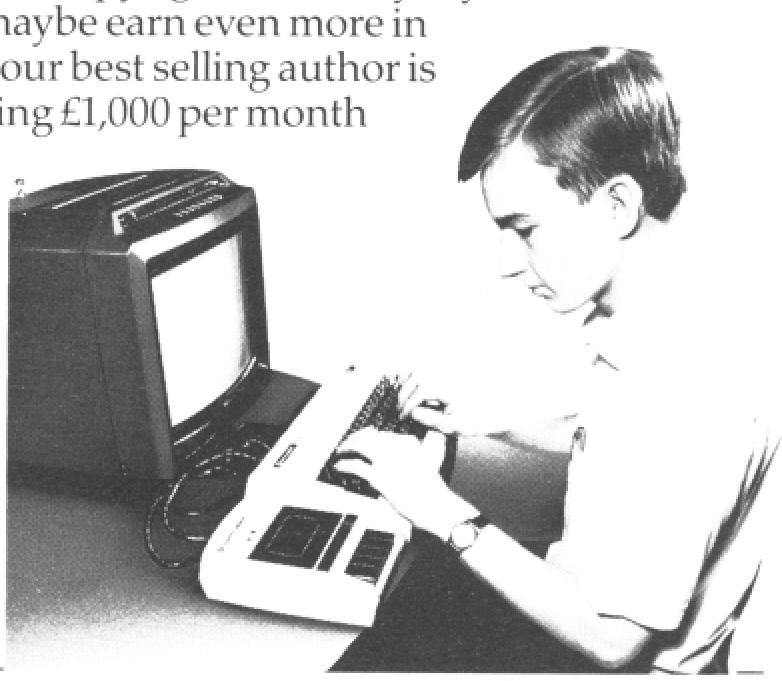
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```
590 GA$="INVALID - REDO"
600 GOTO 660
610 GA$="NO WORD AT "+STR$(ITEM)
620 GOTO 660
630 GA$="YES YOU CAN GO!"
640 GOTO 660
650 GA$="NO WAY!"
660 GOSUB 1430
670 PRINT@480,GA$;
680 GOTO 150
690 REM COMPUTER'S TURN
700 FOR AA=1 TO 9
710 IF EB$=LEFT$(P$(NP,AA),2) THEN 800
720 NEXT AA
730 FOR AA=1 TO 9
740 IF EA$=LEFT$(P$(NP,AA),1) THEN 800
750 NEXT AA
760 GOSUB 1430
770 PRINT@480,"I CAN'T GO!";
780 FOR AA=1 TO 900: NEXT AA
790 GOTO 470
800 ITEM=AA
810 THIS$=P$(NP,ITEM)
820 FOR AA=1 TO 900: NEXT AA
830 GOTO 220
840 REM PROGRAM INITIALISATION
850 CLEAR200
860 DIM W$(100).WU(100),P$(9,9
870 REM SET UP DATA
880 FOR MAX=1 TO 100
890 READ W$(MAX): IF W$(MAX)=
900 NEXT MAX
910 MAX=MAX-1
920 NW=9
930 BLANK$=STRING$(10," ")
940 GOTO 60
950 REM INITIALISE FOR DIFFERENT GAME
960 CLS
970 PRINT@13,"CHAINS"
980 PRINT@45,"------"
990 AA=INT((MAX-1)/NW):IF AA>9 THEN AA=9
1000 PRINT"NUMBER OF PLAYERS( 1 -";AA;")";: INPUT PTOT
1010 IF PTOT=0 THEN PTOT=1: PN$(PTOT)="YOUR TURN": GOTO 1070: REM PATIENCE VERSI
ON
1020 IF PTOT>AA THEN 1000
1030 PRINT"PLAYERS' NAMES(MAX 10 CHARS)"
1040 FOR AA=1 TO PTOT
1050 PRINT AA;") ";: INPUT PN$(AA)
1060 NEXT AA
1070 PRINT: PRINT"PRESS ANY KEY TO START"
1080 ITEM=RND(MAX): IF INKEY$="" THEN 1080
1090 RETURN
1100 REM INITIALISE GAME FIELDS
1110 REM INITIALISE WORD AVAILABILITIES
1120 FOR AA=1 TO MAX: WU(AA)=0: NEXT AA
1130 CL=MAX
1140 REM SET UP PLAYERS' WORDS
1150 FOR AA=1 TO PTOT
1160 FOR AB=1 TO NW
1170 ITEM=RND(MAX)
1180 IF WU(ITEM)=1 THEN 1170
1190 P$(AA,AB)=W$(ITEM): WU(ITEM)=1: NEXT AB
1200 WP(AA)=0: WL(AA)=NW: CL=CL-NW
1210 NEXT AA
1220 CLS: PRINT"CHAIN WORD TO THE LAST ONE OR   TWO LETTERS OF THE PREVIOUS WORD
"
1230 GOSUB 1530
1240 PRINT@246,THIS$
1250 MLEN=LEN(THIS$)+1: EA$=RIGHT$(THIS$,1): EB$=RIGHT$(THIS$,2)
1260 NP=0: LAST=0
1270 RETURN
1280 REM PRINT PLAYER'S WORDS
1290 REM CLEAR LOWER PART OF SCREEN
```

**Continued on page 46**

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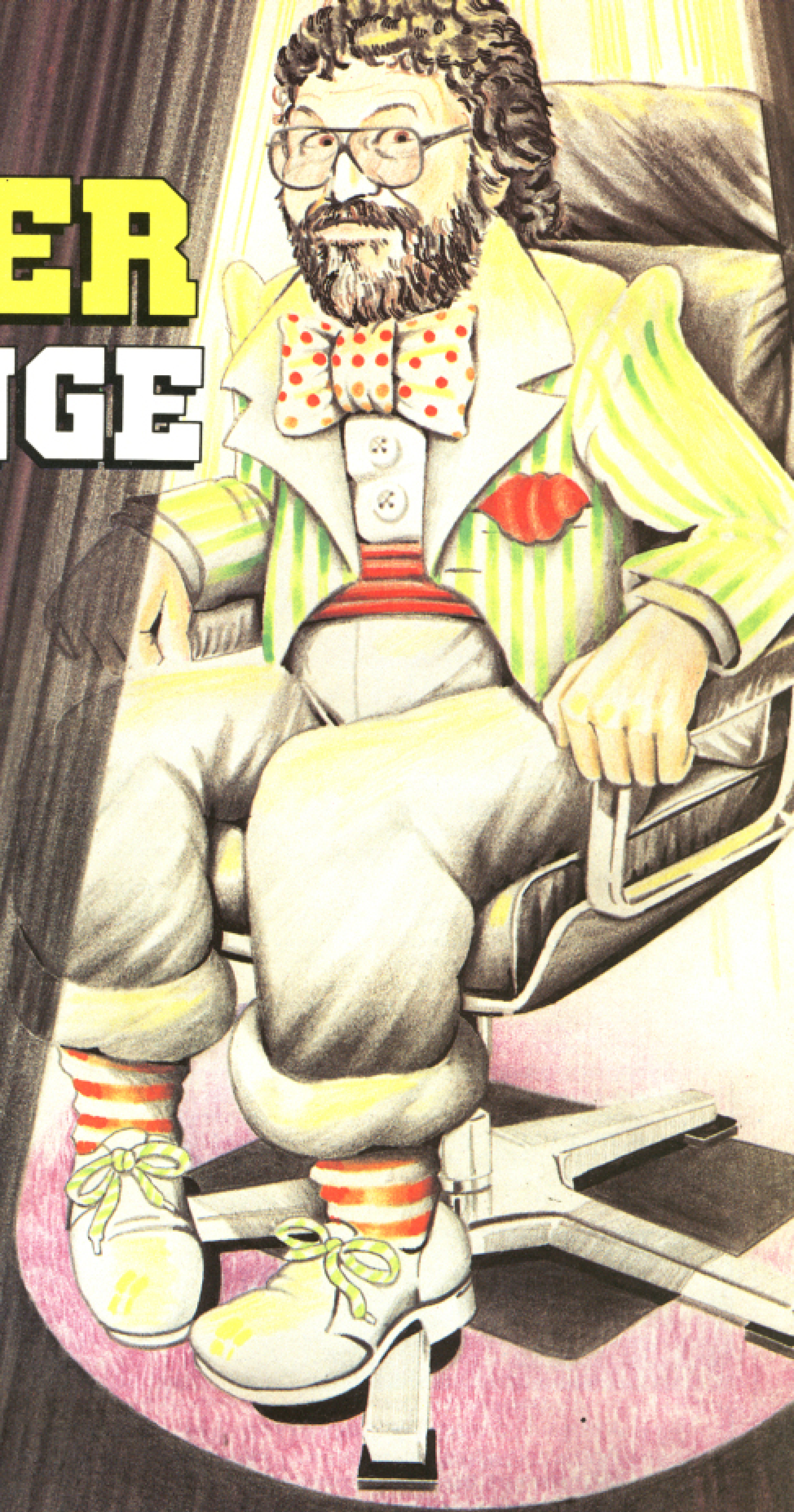
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```
1300 GOSUB 1390
1310 PRINT@320,NP;PN$(NP)
1320 FOR AA=1 TO 3
1330 PRINT@(341+(AA*11)),P$(NP,AA);
1340 PRINT@(340+((AA+3)*11)),P$(NP,(AA+3));
1350 PRINT@(339+((AA+6)*11)),P$(NP,(AA+6));
1360 NEXT AA
1370 RETURN
1380 REM CLEAR LOWER PART OF SCREEN
1390 PRINT@320: PRINT: PRINT: PRINT: PRINT
1400 GOSUB 1430
1410 RETURN
1420 REM CLEAR BOTTOM LINE
1430 FOR AA=0 TO 31
1440 POKE(1504+AA),&H60
1450 NEXT AA
1460 RETURN
1470 REM MOVE WORDS ALONG
1480 FOR AB=1088 TO 1279
1490 POKE AB,PEEK(AB+MLEN)
1500 NEXT AB
1510 RETURN
1520 REM ALLOCATE NEW WORD
1530 ITEM=RND(MAX)
1540 IF WU(ITEM)=1 THEN 1530
1550 THIS$=W$(ITEM): WU(ITEM)=1: CL=CL-1
1560 RETURN
1570 REM UNFINISHABLE GAME
1580 CLS
1590 PRINT@40,"END OF THE CHAIN"
1600 PRINT@106,"WORDS LEFT  PLAYED"
1610 FOR AA=1 TO PTOT
1620 PRINT PN$(AA);: PRINT@(144+((AA-1)*32)),WL(AA);"    ";: PRINT USING "##";WP(
AA)
1630 NEXT AA
1640 GOTO 360
```

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# Beginner's guide to cracking machine code

***Bruce Devlin** provides an introduction to 6809 machine code programming*

HOW MANY TIMES has that Basic program you've written worked far too slowly to give you any excitement? How often have you heard of the speed and excitement of programs written in machine code? How many times have you wondered where to start learning this mystical language? Well look no further — this article is designed to nurse the tender beginner through the first stages in machine code programming.

The first thing to realise about machine code is that we are communicating directly with the microprocessor "brain" of the computer rather than through an interpreter (ie Basic). This explains why machine code is so much faster. Imagine trying to communicate with a Japanese person via an interpreter. It would be much quicker if we were able to talk to him in Japanese. Another important thing to realise is that machine code is byte-oriented. This means that when the computer fetches instructions or data it does so one byte at a time. If we consider a single byte in memory, it may be used for many different things. For example:

1. It may represent a machine code instruction that the microprocessor would read and execute when instructed.
2. It may represent an unsigned number between 0 and 255.
3. It may represent a signed number between — 128 and 127.
4. It may represent a character by containing an ASCII code.
5. It may represent eight binary on/off switches.

If the right electrical connections are made to the micro-processor by the manufacturer then the following are also possible:

6. It may cause a character to appear on a video screen.
7. It may cause a pixel pattern (colour or black and white) to appear on a video screen.
8. It may be a port to some electrical equipment.

These are just a few of the uses a byte may be put to at the whim of the programmer.

To demonstrate the difference in speed between machine code and Basic below is a short program which has been written identically in both the languages. (To load the machine code use the machine code loader with this article.)

By dividing the timer result in the Basic program by that in the machine code program you will see how many times faster machine code is for simple calculations.

Not all Basic routines can be performed faster in machine code however. The PAINT command, for example, requires very little interpretation time but quite a lot of execution time.

Enough of the introductory blurb — you are now probably itching to write some code yourself. Strictly speaking, machine code is a series of numbers in memory which the computer understands. Trying to remember which number does which instruction is nearly impossible so a language called "assembly language" is used to convert phrases we humans recognise (mnemonics) into numbers that the computer recognises (op-codes). The program which runs assembly language is known as an Assembler.

Assembly language consists of a number of lines. Each line can have up to four parts: Label — Instruction — Data — Comment. For example: @LOOP — SUBA — #7 — Subtract 7 from A accumulator.

Label is used to indicate to the assembler that whenever the word @LOOP appears then this is the bit of program we are talking about. In Basic we use the phrase GOTO linenumber. In machine code we use JP label (JP means JumP). Therefore the label can be thought of as a type of line number. The difference is that only the lines that need labels are given them; all others are left blank. In reality the label is equivalent to the memory address where the instruction is stored.

Instruction is the part which is converted into a number and put into memory, telling the computer what to do. In this case SUBA tells the computer to SUBtract something from accumulator A.

Data is the part which is converted into a number and put into memory, telling the computer what information the instruction is to use. This could take the form of a number, an address, a register name, an ASCII character etc. In this case #7 means "the number 7".

Comment is ignored by the assembler and is only there to make life easier for the programmer to follow the program. ▶

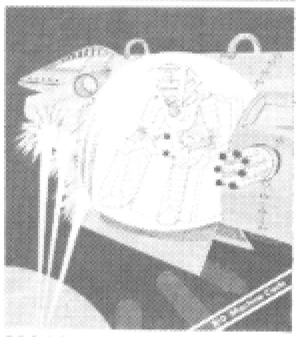
```
10 TIMER =0
20 GOSUB 100
30 PRINT TIMER : END
100 D=&H1000
110 D=D-1
120 IF D<>0 THEN 110
130 RETURN
```

```
10 GOSUB 1000:TIMER=0
20 EXEC &H6000
30 PRINT TIMER : END
(C)COPYRIGHT COMPUSENSE LTD 1983 DASM 1.6
6000                1001        ALL
6000 CC1000         1010        LDD #$1000
6003 830001         1020 @LOOP  SUBD #1
6006 26FB           1030        BNE @LOOP
6008 39             1040        RTS
6009                1050        END
```

*This short program – in Basic at left and in machine code at right – shows the difference in speed between the two.*

# Action Packed 100% Machine Code Arcade Software for DRAGON 32

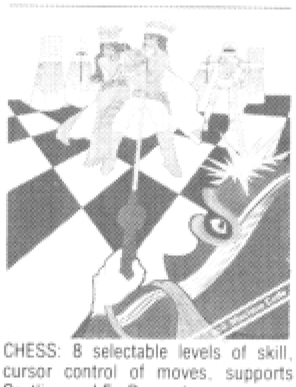
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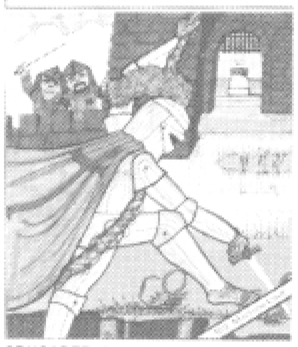
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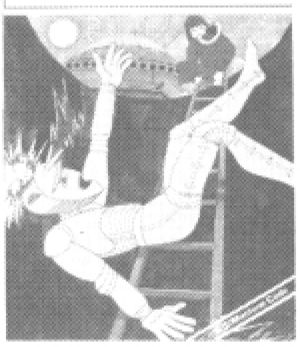
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# Machine code loader

THE FOLLOWING SHORT program is a useful machine code loader. The best way to use it is by first saving it on cassette, then loading it before you type in one of the example programs.

The program displays the memory location currently being altered along with the previous two and the following two. Using the up and down arrow keys enables you to scroll through memory. (The ENTER key has the same effect as the down arrow key.) To enter a hex digit just press the key and you will see it appears at the right-hand side of the number as it shifts left. To exit from the loader press the CLEAR key. You will be returned to your program.

```
1000 REM**MACHINE CODE LOADER**
1001 CLEAR 200,&H5000
1010 CLS : INPUT "START LOCATION ";LOC
1020 PRINT @128,"DEC      HEX       HEX"
1030 PRINT @160,"ADDR     ADDR      VALUE"
1040 FOR I=LOC-2 TO LOC+2
1050 PRINT USING"#####    %  %  =  %%";I;HEX$(I);HEX$(PEEK(I))
1060 NEXT I
1070 PRINT @273,HEX$(PEEK(LOC))"<=="
1080 A$=INKEY$:IF A$=""THEN1080
1090 IF A$="^"THEN LOC=LOC-1:GOTO1030
1100 IF A$=CHR$(10) OR A$=CHR$(13) THEN LOC=LOC+1 : GOTO 1030
1110 IF A$=CHR$(12) THEN CLS:RETURN
1120 A=INSTR(1,"0123456789ABCDEF",A$)-1
1130 IF A<0THEN SOUND 100,1:GOTO 1080
1140 POKE LOC,A+16*(PEEK(LOC)AND15):GOTO 1070
```

A typical line that would be entered by the loader is:

```
6000      F67FFF      1010      LDB $7FFF      B=KEY PRESSED
 1          2           3           4                5
```

1 — Address: This is entered at the INPUT statement when the program is running. When entering data, keep a check on the address to make sure it is the same as that given in the listing.

2 — HEX data: Each byte consists of two characters and each should be entered (even if one of them is zero). To key in the data in this example type
F6 ENTER
7F ENTER
FF ENTER

3 — Line number: A quirk of this particular assembler; please ignore.

4 — Assembly language: This is the instruction written in assembly language.

5 — Comment: These have been added to help you follow the program.

◀ The microprocessor "brain" inside the Dragon 32 is a 6809E manufactured by Motorola and is one of the most powerful 8-bit microprocessors on the market.

The 6809 is capable of 8-bit operations (acting on one byte at a time) and some 16-bit operations (acting on two bytes simultaneously).

## Operations in registers

These operations are performed mainly in the registers. These are internal "variables" in which arithmetic and logic is performed. The registers are:

A — This is known as the A accumulator. Simple arithmetic and logic can be performed on an 8-bit number in this accumulator.

B — This is also an accumulator and is identical to A in operation.

D — This is a 16-bit accumulator having A as the first byte and B as the second byte. For example, if A contains &H12 and B contains &H34 then D = &H1234.

S — This is the system stack.

PC — This is the program counter, perhaps the most important register because it tells the computer where the next instruction is in memory. It is updated with every instruction executed.

CC — This is the condition code register. It contains a number of flags which are updated (if necessary) instantly after every instruction is executed. They are used to indicate what happened after the last instruction (zero answer, negative answer, overflow and so on).

DP — This is the direct page register which will not concern us as yet.

X — This is an index register and is used for indexed addressing. This means that X contains a number which will be used as an address. For example, if X contains &H6A4F and the instruction LDA,X is encountered, then the A accumulator will be loaded from location &H6A4F.

Y — This is an index register and is identical in operation to X.

U — This is the user stack. It is identical in operation to S but is not used by the system.

Now that you know what registers you have, the next thing to learn is what you can do with them. Here are a few instructions for moving numbers: LD, ST, CLR. These are mnemonics (abbreviated phrases) for the following commands.

LD = LoaD — This will load a number into a register. For example, LDA #7 is similar to the Basic statement LET A = 7.

ST = STore — This will store the contents of a register in memory. This is similar to the Basic statement POKE address, A.

CLR = CLeaR — This will load a register with zero quickly.

The vital thing to realise about machine code is that the variables where you remember things such as the position of a spaceship in a video game or the name of the person using the program are no longer names but memory locations, and the variables that you use for calculating are the registers. For example, if you stored the number of points a player has in location &H6001 and you wanted to add three to it then you could do it like this:

```
1 LDA $6001
2 ADDA #3
3 STA $6001
```

Note that in assembler HEX is represented by a $ and not by &H.

Line 1 — Load accumulator A from location &H6001. Note that no # sign is present. If the instruction were LDA #6001 then the microprocessor would try and load A with the decimal *number* 6001 and *not* load A from *memory* location &H6001.

Line 2 — ADD the decimal number 3 to the A accumulator.

Line 3 — Store the A accumulator back in location 6001 hex.

## Addressing modes

The way data is given to an instruction is known as the addressing mode. The #n (n is a number) is known as immediate addressing. It means use the number n. The case where an address (or label) follows the instruction is known as extended addressing. It means use the number in this memory location. The following are examples of extended addressing.

LDB 18462 = Load accumulator from decimal memory location 18462.

CLR @TOP = Clear memory location referred to by the label @TOP.

STX $642 = Store index register X in locations &H642 and &H643. (X is a two byte register; the first byte is stored in &H642 and the second in &H643).

As mentioned before, another type of addressing is indexed addressing. Here, instead of specifying an address, you give the name of a register. Imagine the X register contains the address of a square on the text screen (&H4FF, for example, is half way down on the right hand side), and the B accumulator contains the number 223 (ASCII code for a cyan blob). Storing accumulator B at the location specified by X will cause a cyan blob to appear half-way down the screen on the right-hand side.

7000 8E 04 00 LDX #$400 — Load X with screen address.

7003 C6 DF LDB #223 — Load B with code for cyan blob.

7005 E7 84 STB ,X — Store blob on screen.

7007 39 RTS — Return to Basic.

## Auto-increment

Another version of indexed addressing is known as Auto-increment (eg STB ,X+). This is the same as before except that after B has been stored, the microprocessor performs X = X + 1; so, in the above example, if STB ,X+ were used, then when RTS was reached the X register would contain the value &H500 (&H4FF+1). Before reading on, work ▶

```
10 GOSUB 1000
20 A$=INKEY$ : IF A$="" THEN 20
30 POKE &H7FFF,ASC(A$) : EXEC &H6000
40 GOTO 20
(C)COPYRIGHT COMPUSENSE LTD 1983 DASM 1.6
6000                 1001      ALL
6000 F67FFF          1010      LDB $7FFF   B=KEY PRESSED
6003 8E0400          1020      LDX #$400   X=ADDRESS OF SCREEN TOP LEFT
6006 E780            1030 @LOOP STB ,X+    STORE CHARACTER ON SCREEN
6008                 1040 *                AND POINT X TO THE NEXT LOCATION
6008 8C0600          1050      CMPX #$600  DOES X POINT OFF THE SCREEN
600B 26F9            1060      BNE @LOOP   IF NOT THEN GOTO @LOOP
600D 39              1070      RTS         RETURN TO BASIC
600E                 1080      END
```

*Program 1: clears the screen with the key you press on the keyboard.*

◀ your way through Program No 1. This program will clear the screen with the key you press on the keyboard.

Arithmetic that the 6809 can perform is either 1 or 2-byte integer arithmetic. Using 1 byte means the numbers 0 — 255 or −128 to +127 can be used. Using 2 bytes means the numbers 0-65536 or −32768 to +32767 can be used.

If decimal points are to be used, the floating point representation is used. This takes between 4 and 16 bytes per number and all arithmetic takes many machine code instructions. It is therefore much slower and more complex, but required if SIN, COS and TAN etc. are to be used. We will only deal with integer arithmetic.

The main arithmetical instructions are as follows:

ADD — Add an 8-bit number to A (or B) and store the result in that register. For example, add 19 to memory location &H100:

LDA 19 — Let accumulator A = 19 (decimal).

ADDA $100 — Add contents of location &H100 to A.

STA $100 — Store the result (currently in A) in location 100hex.

SUB — Subtract an 8-bit number from A (or B) and store the result in that register. For example, perform the sum @CHANGE = @MONEY − @COST where CHANGE, @MONEY and @COST are labels which have been previously defined.

LDB @MONEY — Load B with the number at the memory location referred to by label @MONEY.

SUBB @COST — Subtract contents of @COST.

STB @CHANGE — Store the result at location @CHANGE.

As with both of the above instructions, if the numbers were 16-bit and not 8-bit then the D register would have been used (LDD, ADDD SUBD, STD etc, using two memory locations).

INC — Add one to a memory location or accumulator (not D).

INCA — Add one to A.

INC X — Let the memory location indexed by the X register = its original value + 1.

DEC — Subtract one from a memory location or accumulator (not D). ▶

◀ DECB — B = B — 1.
DEC $71B3 — Let contents of &H71B3 = contents of &H71B3 − 1.

MUL — Multiply A and B accumulators and store the result in D.

LDD #$1234 — Let A = &H12 and let B = &H34.
MUL — Let D = &H12∗&H34 = &H3A8.

When using these functions the results will be 100 percent predictable if all the numbers (including the results) are in the range 0 — 255 (that is, hex FF and binary 1111 1111), but what would happen if we tried:

LDA #6 A = 6
SUB #7 A = A − 7 ??

Let's try the sum in binary:

```
      6 = 0000 0110
      7 = 0000 0111
..11|1|1111|1111
```

(Work through the sum yourself remembering that to perform 0 − 1 you have to "borrow a 1" giving 10 − 1 which in decimal = 2 − 1.)

## Endless ones

You will see the answer is an endless string of ones. As we have only 8 bits to play with, the number −1 is represented by hex FF. Let's just make certain that this works. The sum 1 + (−1) = 0

```
    1 = 0000 0001
  − 1 = 1111 1111 +
  1|0000|0000
```

If we pretend to be the computer and only look at the right hand eight bits then we see that this works — the answer is zero. This is known as the twos complement method of storing negative numbers. The method for calculating a negative number is as follows:

Let's take the example 42 (hex 2A). First write out the number in binary 0010 1010. Now invert all the bits 1101 0101 and finally add one 1101 0110 = −42 = &HD6. You will notice that for negative numbers the left-hand bit is always one. I will leave it to you to show that +128 has the same binary representation as −128. This gives us the numbers +127 down to −128 if we so choose. The instruction NEG (NEGate) will turn a positive number into a negative or vice-versa. For example:

LDA 32651 — Load A from memory location decimal 32651.
NEGA — Negate it.
STA 32652 — Store it in location 32652.

## Negation

As with INC and DEC, if we want to negate the contents of memory location 36142 we merely enter NEG 36142 into our assembler.

When arithmetic is performed (whether you choose numbers to be in the range 0-255 or −128 to + 127), a register called the condition code register is updated. This register stores information so that decisions can be made by using the branch instruction.

Consider the Basic statement:

20 IF B = 4 THEN GOTO 50

To convert this to a similar machine code statement we use the CMP (CoMPare) instruction. This instruction works exactly the same as the SUBtract instruction except that the final result is not stored, and only the condition code register is affected. Therefore in machine code we get:

1. CMPB #4 — Perform B = B − 4 and remember result but do not store it.

2. BNE @LINE50 — If the result of the previous statement was zero then go to the line with the label @LINE50 otherwise continue with the next instruction.

The table above shows branch statements along with the conditions about the last instruction that cause them to be true (that is, branch). The branch statement is similar to the Basic GOTO command. The difference is that the branch statement adds a number between −128 and +127 to the program counter to find the required instruction, whereas the GOTO statement is more like the JMP (JuMP) instruction which physically loads a number into the program counter to get the new address.

| Name | Mnemonic | condition |
|---|---|---|
| carry clear | BCC | carry flag clear |
| carry set | BCS | carry flag set |
| equal zero | BEQ | last number zero |
| greater or equal | BGE | last result >=Ø (S) |
| greater than | BGT | last result >Ø (S) |
| higher than | BHI | last result >Ø |
| higher or same | BHS | last result >=Ø |
| less than or equal | BLE | last result <=Ø (S) |
| lower than | BLO | last result <Ø |
| lower or same | BLS | last result <=Ø |
| less than | BLT | last result <Ø (S) |
| minus | BMI | last number negative |
| not equal to zero | BNE | last number not zero |
| plus | BPL | last number positive |
| always | BRA | always |
| never | BRN | never |
| no overflow | BVC | overflow flag clear |
| overflow | BVS | overflow flag set |

*Branch conditions: (S) indicates a signed (– 128 to + 127) number.*

```
10 GOSUB 1000
20 INPUT "STRING OF LETTERS ";A$
30 REM*POKE VARPTR(A$) INTO LOCNS &H7FF0 + &H7FF1
40 POKE &H7FF0,INT(VARPTR(A$)/256)
50 POKE&H7FF1,(VARPTR(A$)AND255)
60 CLS
70 EXEC &H6000:PRINT @224,A$
80 PRINT PEEK(&H7FFF);" MOVES";
90 IF PEEK(&H7FF0)=0 THEN PRINT "-FINISHED":GOTO 20
100 IF INKEY$=""THEN100 ELSE 70
(C)COPYRIGHT COMPUSENSE LTD 1983 DASM 1.6
6000              1001       ALL
6000 BE7FF0       1010       LDX $7FF0    X=VARPTR(A$)
6003 E684         1020       LDB ,X       B=LENGTH OF STRING
6005 271E         1030       BEQ @FINISH  IF LENGTH=0 THEN FINISH.
6007              1040 *                  IT ISNT POSSIBLE TO SORT
6007              1050 *                  ZERO LETTERS
6007 5A           1060       DECB
6008 271B         1070       BEQ @FINISH  LIKEWISE FOR ONE LETTER
600A AE02         1080       LDX 2,X      X=ADDRESS OF STRING
600C 7F7FFF       1090       CLR $7FFF    NO. MOVES =0
600F A680         1100 @LOOP LDA ,X+      A=LETTER IN STRING;X=X+1
6011 A184         1110       CMPA ,X      COMPARE WITH NEXT LETTER
6013 230D         1120       BLS @COUNT   IF FIRST LETTER<SECOND THEN GOTO @CO
UNT
6015 7C7FFF       1130       INC $7FFF    INC NO. MOVES
6018 A7E2         1140       STA ,-S      S=S-1 ; THEN STORE A IN ,S
601A              1150 *                  I.E. PUSH A ONTO STACK
601A A684         1160       LDA ,X       A=SECOND CHARACTER
601C A71F         1170       STA -1,X     STORE A IN FIRST LETTERS POSITION
601E              1180 *                  I.E. ,(X-1) WHICH IS WRITTEN -1,X
601E A6E0         1190       LDA ,S+      PULL FIRST CHARACTER OFF STACK
6020 A784         1200       STA ,X       STORE A IN SECOND CHARACTERS
6022              1210 *                  POSITION COMPLETING SWOP
6022 5A           1220 @COUNT DECB        DEC COUNTER (LENGTH OF STRING)
6023 26EA         1230       BNE @LOOP    IF NOT ZERO THEN LOOP
6025 39           1240 @FINISH RTS        RETURN TO BASIC
6026              1250       END
```

*Program 2: a ripple sort program to try on your own.*

## On your own

You should now be able to work your way through Program No 2 which is a ripple sort program. It will ask you to type in a string of letters which it will then sort into alphabetical order. (All listings courtesy of the Micro Centre in Rugby.) ■

# The Dragon and Seikosha—a print partnership

***James Greenall*** *goes into print on the Dragon 32 and the Seikosha GP-100A*



THIS ARTICLE EXAMINES the high resolution graphics dump from a Dragon on to a Seikosha GP100A, a topic touched upon in Keith Brain's article in the May edition of *Dragon User*. It also shows the Dragon user how to use the dump program in conjunction with programs creating designs on the graphics screen.

## The hi-res screen

The Dragon 32 graphics screen is made up of 192 by 256 pixels or dots in the highest resolution mode. Each of these pixels represents one bit in the part of the computer's memory that holds the information displayed on the screen. Each byte is, of course, made up of eight bits. Therefore, each row of dots across the screen takes 32 bytes of memory (256/8) and the whole screen takes 6,144 bytes (32 × 192). A pixel is printed on the screen if the bit is set to one.

## The printer

Unfortunately for the user, the graphics mode on the GP100A printer does not correspond to the same type of "bit mapping" as the screen. Whereas on the screen each byte represents a short horizontal line, on the printer this line is vertical. Each "character" printed in graphics mode represents seven bits printed vertically and the eighth bit (the bottom one) of each byte is always set to one. The bits count from 0 to 128 from top to bottom. The printer prints graphics from the instruction PRINT£-2, CHR$(X) where X is 128 plus the value of the bits to be printed. For example, one dot printed in the top left-hand corner of the page would be printed by the command PRINT£-2, CHR$(129).

## Compiling print characters

The first print character is therefore made up of the first pixel of each of the first seven lines of screen. To detect whether the pixel is set or not we can use the PPOINT command which returns the value of the relevant bit from the display file. The value of these bits then needs to be multiplied by the relevant power of two to compute the CHR$ value of the graphics character to be printed. This is done by line 1020 of Program 1. X represents the vertical axis and Y the horizontal axis of the screen display. PPOINT detects whether the bit is 0 or 1 and multiplies the result by the relevant power of two working down the screen. 128 (the base value) is then added to the total.

The FOR . . . NEXT loops on X and Y repeat the calculation for the whole screen working seven rows at a time (hence STEP 7) across and then down.

## Using the program

Type in Program 1 and then CSAVE it. To verify the program, rewind the tape and attempt to CLOAD it before entering NEW or switching off the computer. If the program has not saved satisfactorily, the error report will be displayed but your program will still be in memory. If the program has saved properly you will get the usual OK prompt.

Now type in Program 2. This is just a simple graphics program which draws a series of straight lines on the screen crossing each other to form a curve. RUN the program and press BREAK to return to Basic. It is a feature of the Dragon that the high resolution screen is retained until the computer is switched off or the command PCLS is used. Thus the loading of a new program or entering NEW does not affect the picture which has been drawn. You may therefore load Program 1 and RUN it. A copy of the screen will be produced by your printer.

Whilst a faithful reproduction of your screen, the hard-copy produced does not use the printer to its best advantage as the result uses only 51 columns, little more than half the printer's width. To maximise the effect of the printed output, therefore, it would be more effective if we could double the size of the printed picture and print it on its side.

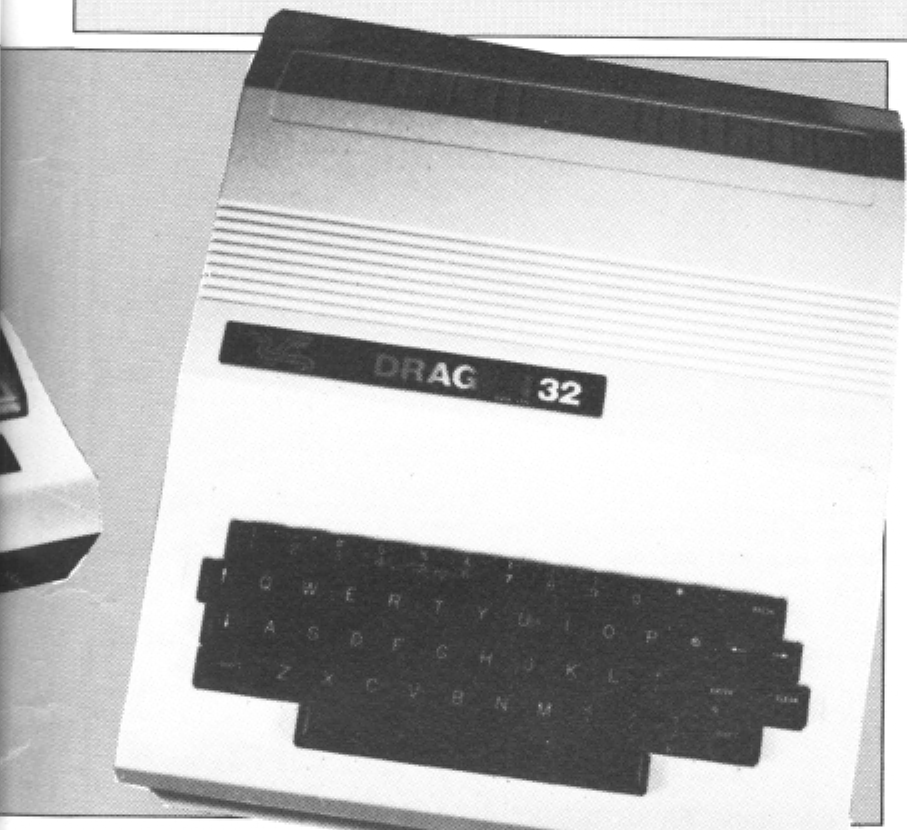
This is the effect of Program 3. It moves from the top right corner of the screen down computing each bit twice and printing each graphics character twice, thus producing a print that is four times the area of that produced by Program 1.

## Hard copy made easy

The ability of the Dragon to retain its screen as mentioned above makes the production of hard-copy screen dumps very easy. All that is required is that, having run the program to set up the screen, you load and run the dump program. This can be applied to any graphics program in which it is possible to LOAD another program without switching off the computer. ■

## PROGRAM 1

```
10 PMODE 4,1:SCREEN 1,0:REM SELECT HIGH RES GRAPHICS MODE
20 PRINT£-2,CHR$(8):REM SET PRINTER TO GRAPHICS MODE
30 FOR X= 0 TO 191 STEP 7:REM WORK DOWN THE SCREEN 7 LINES AT A TIME
40 FOR Y=0 TO 255:REM WORK ACROSS THE SCREEN FROM LEFT TO RIGHT
50 A=PPOINT(Y,X)+PPOINT(Y,X+1)*2+PPOINT(Y,X+2)*4+PPOINT(Y,X+3)*8+PPOINT(Y,X+4)*1
6+PPOINT(Y,X+5)*32+PPOINT(Y,X+6)*64+128:REM CALCULATE PRINT CHARACTER
60 PRINT£-2,CHR$(A);:REM SEND CHARACTER TO PRINTER
70 NEXTY:REM START NEXT CHARACTER
80 PRINT£-2,CHR$(13);:REM TELL PRINTER TO START A NEW LINE
90 NEXT X:REM START NEXT PRINT LINE
100 PRINT£-2,CHR$(15):REM RETURN PRINTER TO CHARACTER MODE
```




Program 1 (above) sets up the hi-res print routine. To verify it, rewind the tape and attempt to CLOAD it before entering NEW or switching off the computer.

## PROGRAM 2

```
10 PMODE4,1:SCREEN1,0:PCLS
20 FORX=0TO191STEP8
30 LINE(X+64,0)-(255,X),PSET
40 LINE(X+64,191)-(255,191-X),PSET
50 NEXT
60 FORX=191TO0STEP-8
70 LINE(0,191-X)-(X,0),PSET
80 LINE(0,X)-(X,191),PSET
90 NEXT
100 GOTO100
```

Program 2 (above) is a simple graphics program which draws a series of straight lines on the screen crossing each other to form a curve.

Program 3 (below) doubles the size of the printed picture and prints it on its side thus using the printer to its maximum width.

## PROGRAM 3

```
10 PMODE 4,1:SCREEN 1,0:REM SET HIGH RES. GRAPHICS MODE
20 PRINT £-2, CHR$(8):REM SET PRINTER TO GRAPHICS MODE
30 FOR X=255 TO 0 STEP-7:REM WORK ACROSS SCREEN FROM RIGHT TO LEFT 7 LINES AT A
TIME
40 FOR Y=0 TO 191:REM WORK DOWN THE SCREEN CALCULATING FIRST HALF OF 7 LINE BLOC
K
50 A=PPOINT(X,Y)+PPOINT(X,Y)*2+PPOINT(X-1,Y)*4+PPOINT(X-1,Y)*8+PPOINT(X-2,Y)*16+
PPOINT(X-2,Y)*32+PPOINT(X-3,Y)*64+128:REM CALCULATE PRINT CHARACTER USING EACH P
IXEL TWICE
60 PRINT £-2,CHR$(A);CHR$(A);:REM SEND CHARACTER TO PRINTER TWICE
70 NEXT Y:REM START NEXT CHARACTER
80 PRINT £-2,CHR$(13);:REM TELL PRINTER TO START A NEW LINE
90 FOR Y=0 TO 191:REM WORK DOWN SCREEN CALCULATING SECOND HALF OF 7 LINE BLOCK
100 IF X>3 THEN A=PPOINT(X-3,Y)+PPOINT(X-4,Y)*2+PPOINT(X-4,Y)*4+PPOINT(X-5,Y)*8+
PPOINT(X-5,Y)*16+PPOINT(X-6,Y)*32+PPOINT(X-6,Y)*64+128 ELSE A=PPOINT(X-3,Y)+128:
REM CALCULATE PRINT CHARACTER
110 PRINT £-2,CHR$(A);CHR$(A);:REM SEND CHARACTER TO PRINTER TWICE
120 NEXT Y:REM START NEXT CHARACTER
130 PRINT £-2,CHR$(13);:REM TELL PRINTER TO START A NEW LINE
140 NEXT X:REM START NEXT BLOCK OF 7 LINES
150 PRINT £-2,CHR$(15):REM RETURN PRINTER TO CHARACTER MODE
```

# OPEN FILE FOR DRAGON USERS

**Send us your Dragon programs, beginning with a general description and then explaining how the program is constructed. Take care that the listings are all bug-free, enclosing a cassette and, if possible, a printout. We pay £6 for each bug-free program published, double for the program of the month. If you have any problems with the listings, please send your queries to the appropriate author, *Dragon User*, 12-13 Little Newport Street, London WC2R 3LD.**

## Happy birthday

*From Luke Adams in Warley*

THIS IS A music and graphics demonstration that is ideal for bithday parties, especially if your Dragon was a birthday present.

Part of the program was adapted from W. Slater's "Drawing" routine printed in May's *Dragon User*.

A cake is drawn with the appropriate number of candles, the candles lit and "Happy Birthday to You" played; then, when a key is pressed, the candles appear to go out. This is achieved by switching from the first four graphics pages (which have the cake with candles alight on them) to the last four, which have unlit candles on them.

**Program notes**

| | |
|---|---|
| 40 | INPUTs age. |
| 60-120 | Draws cake. |
| 140 | PLAYs tune. |
| 160-230 | Draws candles and flames. |
| 240 | Copies graphics. |
| 260 | Checks keyboard. |
| 270 | Switches to next graphic screen. |
| 280 | Infinite loop (press BREAK to end). |

```
0 'BIRTHDAY CAKE
20 'BY LUKE ADAMS
30 PCLEAR 8
40 CLS:INPUT"HOW OLD ARE YOU ";O
50 PMODE3,1:SCREEN1,0:PCLS1
60 CIRCLE(128,96),60,4,.3
70 CIRCLE(128,128),60,4,.3,0,.5
80 COLOR4,1
90 LINE(68,96)-(68,128),PSET
100 LINE(188,96)-(188,128),PSET
110 PAINT(128,96),2,4
120 PAINT(128,128),2,4
130 GOSUB160
140 PLAY"O2;T3;L8;CC;L8.;D;L4;CFE;P9;L8;CC;L8.;D;L4;CGF;P9;L8;CC;O3;L4;C;O2;AFED
;L8;B-D-;L4;AFGF"
150 GOTO260
160 DEF FN R(X)=4.0*ATN(1.0)
170 FOR T=1 TO O
180 A=T/(O/2)*FN R(A)
190 X=128+50*COS(A)
200 Y=96+15*SIN(A)
210 IF P=0 THEN LINE(X,Y)-(X,Y-10),PSET
220 IF P=1 THEN CIRCLE(X,Y-10),5,3,1.5:CIRCLE(X,Y-10),4,4,.25
230 NEXT T
240 IF P=1 THEN 250 ELSE IF P=0 THENPCOPY1 TO 5:PCOPY2 TO 6:PCOPY3 TO 7:PCOPY4 T
O 8:P=1:GOTO170
250 RETURN
260 E=PEEK(65280):IF E=255 OR E=127 THEN 260 ELSE 270
270 PMODE3,5:SCREEN1,0
280 GOTO 280
```

## World map

*From P Williams in Gainsborough*

THIS PROGRAM produces a map of the world on the screen. It would be suitable for use in games or as a basis of a geography lesson.

The program is quite straightforward and utilises the Dragon's Draw facility. Experimenting with the P MODE and SCREEN in line 50 will produce slightly different results.

```
10 REM****************************
20 REM MAP OF THE WORLD
30 REM****************************
40 REM(C)P.WILLIAMS 1983
50 PMODE 4,1:SCREEN 1,0:PCLS
60 DRAW"BM2,24;E2R4U4E6R4E2E4F4D2F4R8F4E4H4E6F4R2H4E4F4D4E6H2E2F2G4R6G4R2D4R2D2G
4D2"
70 DRAW"BM74,24;H6L6U2R2U4G6D2L6G6D4R4D4R2U4R4U4E6R2D4R4D4F4G4R2D2L6U2G2H2G1F2G2
F2E2F2"
80 DRAW"BM70,40;G6H1E2H1G11H3D1F3G11D6L2U4G1H4L2F2L6G4D6F4E4R2G6R3D6F6E6R2F4R4D2
R2F6R4D4"
90 DRAW"BM66,104;G2F2E2F6D12G8D12G8L4F3D2G6D6F4D6F3R2D2L6H8U4H3E2U36E2"
100 DRAW"BM46,129;U4H6U4H2U4E4U2L4U4L4H10L3H4U6E2U8L2D6L1U8E2U14R1D2R1U8H6L2U2L2
D2L6H6U8"
110 DRAW"BM92,6;R20G2R8G6D4G2H2G2F2G6L4G14H4U6E6U4L6U3E5H6E8F5"
120 DRAW"BM98,32;F1R4D2G2L2H2E2"
130 DRAW"BM108,40;R4G2R2D2G2D2F4D2L2R2D2L6G2U2E2L2E2L2E2U2L4D4G4H2U4E2R6U4L2E4"
140 DRAW"BM192,10;H4G2F8G2L6D2G3L4H2L2D4L4U2L4U2E6H2G8F4R2D2L6H3G2D2G4U4H3L10G4D
2G4L4G6D4F2E2R1"
150 DRAW"BM130,45;D4R2U2E3U5E5F1G4D6G6L2G2L2H2U2L2D2G2L
```

**Continued on page 61**

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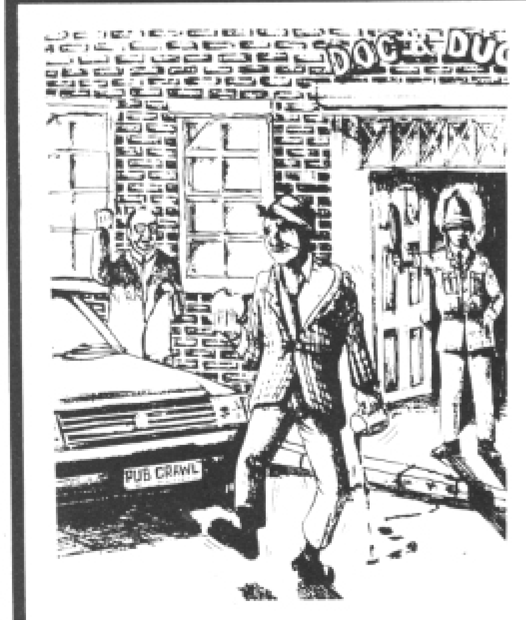
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```
2G2L2G4L4D2F1R1D1F1R1D1L8G2D5F2D2R2E2"
160 DRAW"BM106,74:    U5R4E6F9D2E4H10R4F6D2F6E3H2E1F2R2E2H3U2E2F3E2F3G3L6G3L2D2F2
R6D2G4L6H4L2D2"
170 DRAW"BM126,80:L6H2U2H2L8G4L4G4D2G4D14F6R6E2R6F2D16F3D8G3D5F2D2F2D2F2D2F2"
180 DRAW"BM124,158:E10U2E4U4E2H4E8F3D8F2E4U4E4U4L2G4L2D2L2H3E2H3U9E15H1L4G2L3H1U
4H4U2L2U2L1U2L1"
190 DRAW"BM145,86:R2U3F8E8U4H3G2D2G2H2U1H1E2F6R6F2R4E2R3F2D4R3F2D4F2D2F4"
200 DRAW"BM190,100:E2F3G2H2E2H1E2U4E6F2D4R4D2R2D4R1D2R1D2R1D2R1D2R2U4H4U2H4U3R2F
6R4U4H6U6R3"
210 DRAW"BM215,80:D2R2E3R2E4U2E4U4H8E3H4R4D2F4R2E2H4E6U10R4U3L8U2E4R8H6R3F6G2F10
U4H5U2R4U2H2E2R6"
220 DRAW"BM254,18:U2H4L6G2L4H2L6H4G3L6E2H4R3U2L6D2F6L4H5D2L4H2G4L6"
230 DRAW"BM246,42:G6D2F2D5G6D5R2U3R4E2U6H3E2U3E4H2"
240 DRAW"BM208,105:D4F12E2G1F4R2F2R3F2R2E2R2F4L3H4L8H16U4L2"
250 DRAW"BM220,108:E8R2F2G2D3F2D4L5H4U4"
260 DRAW"BM240,108:F3D2L2G2D1F2L3H2U4E4"
270 DRAW"BM228,84:R2F8D2G2L2U2H4U4"
280 DRAW"BM242,120:F4R2E2R4D4F4D1L2H4G2H5U2H4U2E2"
290 DRAW"BM232,130:R3D8L2U4L5G4L4G4D2G6D6F2R2E4R10F6D2F2R3D4G2H2R2U2E4U2E2U2E2U6
H2U2H2U2H1U7L4"
300 DRAW"BM252,152:R1D3R1F2D1G2L2D3G2D3G6L2U1E16U4H2E2"
310 DRAW"BM160,56:D2G2D2R2D2F2G3L1H3U1E4H4U1E1R2"
320 DRAW"BM40,76:R4F4R3D2R3D1L3U1L5U2L5U4"
330 GOTO330
```

# Dodge

*From A Bowler in South Humberside*

IN DODGE THE idea is to keep a line moving for as long as possible while dodging an ever-increasing number of dots which appear at random on the screen. The longer you last, the greater your score.

The program also incorporates a list of highest scores and scorers. If a score of 1,500 is reached the game is run again and this total is added to. Note: POKE 65495,0 is used in line 120.

**Program notes**

| | |
|---|---|
| 10-100 | Prints title and asks for name. |
| 110-150 | Speeds up program and draws screen. |
| 160-190 | Sets start position and tests for crash. |
| 200-310 | Draws explosion and prints scores. |
| 320-360 | Another go (Y/N)? |
| 370-430 | Sets line co-ords and dot co-ords and score to 0. |
| 440-480 | Increases difficulty when score is 500 and 1000. |
| 490 | Run game again if score is 1,500. |
| 510-610 | Tests for arrow key depressions and branches to alter direction of line accordingly. |

**Variables**

N$ — Initial name.
NI$ — Highest scorer's name.
OH$ — Old highest scorer's name.
PQ$ — Old second highest scorer's name.
N2$ — Second highest scorer's name.
N3$ — Third highest scorer's name.
X — Initial X co-ordinate of line.
Y — Initial Y co-ordinate of line.

```
10 REM*CLEAR SCREEN:PRINT TITLE*
20 CLS
30 PRINT"          *****************"
40 PRINT"          **BY A.M.BOWLER**"
50 PRINT"          *****28/8/83*****"
60 PRINT"          *****************"
70 PRINT"               *******                       **DODGE**
    *******"
80 PRINT:PRINT"USE ARROW KEYS TO CHANGE                DIRECTION"
90 PRINT
100 PRINT"WHAT IS YOUR NAME?":INPUT N$
110 REM ****SPEED UP PROGRAM****
120 POKE65495,0
130 REM*DRAW OUTLINE:SET START CO-ORDS*
140 SCREEN1,0:PMODE1,1:PCLS
150 LINE(0,0)-(256,191),PSET,B
160 X=128:Y=95
170 IF X=128 AND Y=95 THEN 380 ELSE 190
180 REM**TEST IF HIT SELF OR DOT***
190 A=PPOINT(X,Y):IF A=2 OR A=3 OR A=4 THEN 210 ELSE 380
200 REM*IF CRASHED,DRAW+SOUND CRASH:PRINT SCORE*
210 FOR I=1 TO 8:SOUND I*8,1:CIRCLE(X,Y),I,I:NEXT I
220 CLS:PRINT@7,"*highest scores*                ****************"
230 PRINT:PRINT"   SCORE =";SS;"BY ";N$
240 IF SS>HS THEN OH=HS:OH$=N1$:PQ=H2:PQ$=N2$:N3$=PQ$:H3=PQ:N2$=OH$:H2=OH:N1$=N$
:HS=SS:GOTO 270
250 IF SS>H2 THEN PQ=H2:PQ$=N2$:N3$=PQ$:H3=PQ:N2$=N$:H2=SS:GOTO 270
260 IF SS>H3 THEN N3$=N$:H3=SS
270 PRINT:PRINT:PRINT"HIGHEST SCORE  = ";HS;"BY ";N1$
280 PRINT
290 PRINT" 2 ........";N2$;H2
```

Continued on page 63

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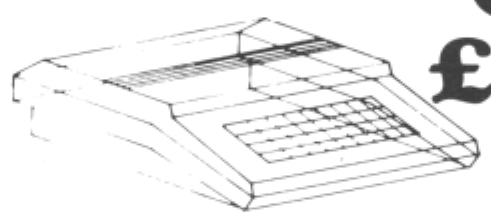
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```
300 PRINT
310 PRINT" 3 ........";N3$;H3
320 REM**ANOTHER GO?**
330 PRINT@450,"ANOTHER GO (Y/N)?"
340 A$=INKEY$:IF A$=""THEN 340 ELSE 350
350 IF A$="Y"THEN 120 ELSE 360
360 IF A$="N"THEN 100 ELSE 340
370 REM***SET LINE CO-ORDS***
380 PSET(X,Y,0)
390 REM***SET RANDOM DOT CO-ORDS AND COLOURS***
400 R=RND(252)+2:R1=RND(188)+2
410 K=RND(3)+1:PSET(R,R1,K)
420 REM**SET SCORE TO 0 FOR NEXT GAME***
430 IF X=128 AND Y=95 THEN SS=0 ELSE SS=SS+1
440 REM*DIVIDE SCREEN WHEN SCORE=500 AND 1000 TO INCREASE DIFFICULTY*
450 IF SS=500 OR SS=1000 THEN 460 ELSE 520
460 R3=RND(256):R5=RND(191):LINE(R3,0)-(R3,R5),PSET
470 LINE(R3,R5+6)-(R3,191),PSET
480 FOR J=1 TO 3:FOR I=1 TO 250 STEP 25:SOUND I,1:NEXTI,J
490 REM***RUN GAME AGAIN IF SCORE=1500***
500 IF SS=1500 THEN RUN
510 REM***TEST FOR KEY DEPRESSIONS THEN BRANCH TO CHANGE CO-ORDS***
520 IF PEEK(341)=223 THEN E=1
530 IF PEEK(342)=223 THEN E=2
540 IF PEEK(343)=223 THEN E=3
550 IF PEEK(344)=223 THEN E=4
560 ON E GOSUB 580,590,600,610
570 GOTO 170
580 Y=Y-2:RETURN
590 Y=Y+2:RETURN
600 X=X-2:RETURN
610 X=X+2:RETURN
```

# Sky-diver

*From D Newby in Derby*

INSTRUCTIONS FOR PLAYING Sky-diver are included in the program.

**Program notes**

| | |
|---|---|
| 150-220 | Sets up hi-res screen. |
| 230-320 | Main loop. |
| 350-450 | Draws parachutist. |
| 460-560 | Movement |
| 570-690 | Scoring table. |
| 830-900 | Instructions. |
| 900-1070 | Crash routine. |

**Variables**

SC — Score.
LI — Lives.
DD — Platform length.
A — Platform position.
X, Y — Co-ordinates of parachutist.
X1, Y1 — Original co-ordinates of parachutist.

```
10 '*****************************
20 '**                         **
30 '**    SKY-DIVER BY         **
40 '**          DAVID NEWBY    **
50 '**              (C)1983    **
60 '**                         **
70 '*****************************
80 GOTO820:'INSTRUCTIONS
90 PCLEAR4:DIMP(40,60),B(20,30)
100 SC=0:LI=3:DD=40:QZ=0
110 PMODE3,1:PCLS
120 GOTO350:'SET UP SHAPES
130 A=RND(230)+10:X=130:Y=0:X1=30:Y1=30
140 IFII=0THENII=1:GOSUB700
150 PCLS:SCREEN1,0
160 COLOR4,1:'SET UP MAIN SCREEN
170 LINE(10,188)-(10,100),PSET
180 DRAW"BM10,100;F5D10G5":COLOR2:DRAW"BM15,105;E2R2F5R2F4R2D6L4H2L2H6L2H5"
190 PAINT(17,110),2,2
200 PAINT(20,110),2,2
210 COLOR3
220 LINE(0,30)-(30,0),PSET:PAINT(1,1),3,3:LINE(226,0)-(256,30),PSET:PAINT(255,1)
,3,3
230 'MAINLOOP
240 IFA>=205 THENZZ=1ELSEIFA<=20THENZZ=0
250 IFZZ<>1THEN270ELSE260
```

**Continued on page 65**

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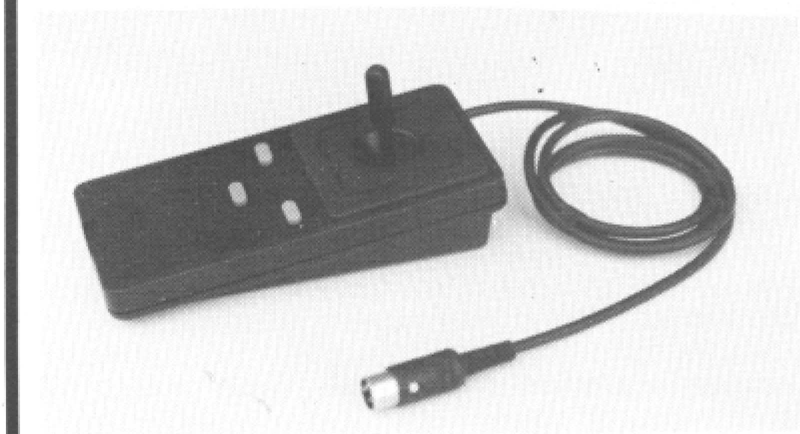
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```
260 A=A-8:GOTO280
270 A=A+8
280 LINE(A+DD,190)-(A+DD+8,190),PRESET:LINE(A-8,190)-(A,190),PRESET:LINE(A,190)-
(A+DD,190),PSET
290 COLOR2:LINE(40,188)-(40,185),PSET:LINE(210,188)-(210,185),PSET:COLOR3
300 GOSUB460:'MOVEMENT
310 IFQQ=1THENQQ=0:GOSUB580:GOTO110
320 GOTO240
330 IFA<=20THENZZ=0
340 IFZZ<>1 THENGOTO270ELSE260
350 'PARACHUTIST
360 DRAW"BM10,60;E5U6E2R3F2D6NL7F5L1H5BU6E5BM10,60;R1E5BU6H5"
370 PAINT(17,53),4,4
380 CIRCLE(20,45),5,2,1.5:PAINT(20,45),2,2
390 CIRCLE(19,30),20,3,1,.5,0:CIRCLE(19,30),20,3,2,.5,0:CIRCLE(19,30),20,3,.5,.5
,0
400 PAINT(20,5),2,3:PAINT(20,15),2,3
410 DRAW"BM0,30;F10BU12M15,40"
420 DRAW"BM39,30;G10BU10M24,40"
430 GET(0,0)-(40,60),P,G
440 GET(100,0)-(140,60),B
450 GOTO130
460 'MOVE PARACUTIST
470 IFPEEK(343)=223 THENRR=2
480 IFPEEK(344)=223 THENRR=4
490 IFRR=2 THENX=X-5:IFX<=40 THENX=40
500 IFRR=4 THENX=X+5:IFX>=170 THENX=170
510 Y=Y+5:IFY>=140 THENSOUND20,5:QQ=1:LI=LI-1:QZ=1:GOTO920
520 IFPPOINT(X+10,Y+55)=3 ANDY<140 THENIFPPOINT(X+25,Y+55)=3 THENPLAY"O3T30GDCBG
DCBBCDG":SC=SC+(10*(40/DD)):QQ=1:RETURN
530 PUT(X1,Y1)-(X1+40,Y1+35),B
540 PUT(X,Y)-(X+40,Y+60),P,PSET
550 X1=X:Y1=Y
560 RETURN
570 'SCORE TABLE
580 CLS:PRINT"YOU SCORED";INT(SC)
590 IFLI=0 THENPRINT"YOU HAVE LOST ALL OF YOUR LIVES.":POKE65494,0:POKE&HFFD6,0:
GOTO770
600 IFQZ=1 THENQZ=0:PRINT"AND YOU FAILED TO LAND"
610 IFLI=1 THENPRINT"YOU HAVE 1 LIFE REMAINING.":GOTO630
620 PRINT"YOU HAVE";LI;"LIVES REMAINING."
630 IFSC>20THENPOKE65495,0:DD=35
640 FORI=1TO1000:NEXTI
650 IFSC>40THENPOKE&HFFD7,0:DD=30
660 IFSC>150 ANDKK=0 THENLI=LI+1:KK=1
670 IFSC>80THENDD=25
680 IFSC>160THENDD=20
690 RETURN
700 CLS:PRINT:PRINT:PRINT"           SKY-DIVER"
710 FORJ=1TO10:PRINT@128," PARACHUTIST IS NOW JUMPING OUT ";
720 FORI=1TO200:NEXTI:PRINT@128,"<                              >";:FORI=1TO200:
NEXTI,J
730 PRINT:PRINT"   PARACHUTE OPENED SAFELY.."
740 PRINT:PRINT"PREPARE TO STEER HIM DOWN SAFELY"
750 FORI=1TO2500:NEXTI
760 RETURN
770 PRINT"ANOTHER GO?(Y/N)"
780 SCREEN0,1
790 AX$=INKEY$:IFAX$="" THEN790
800 IFAX$="Y" THEN100
810 IFAX$="N" THENENDELSE790
820 'INSTRUCTIONS
830 CLS:PRINT"******** DRAGON SKY-DIVER ******";
840 PRINT:PRINT"     BY D.NEWBY (C)1983"
850 PRINT:PRINT" YOU HAVE TO TRY AND LAND THE   PARACHUTIST ON THE MOVING BASE."
860 PRINT" BUT IT SPEEDS UP,ASWELL AS THE BASE SHORTENING..!"
870 PRINT"YOU HAVE THREE LIVES AND 1 EXTRAWHEN YOU REACH 150 POINTS."
880 PRINT@481,"PRESS THE <SPACEBAR> TO START.";
890 PRINT@384,STRING$(32,"£")
900 IFINKEY$=" "THENPRINT@394,"please£wait";:GOTO90:ELSE900
```

Continued on page 67



# D-BUG by Stewart Bush

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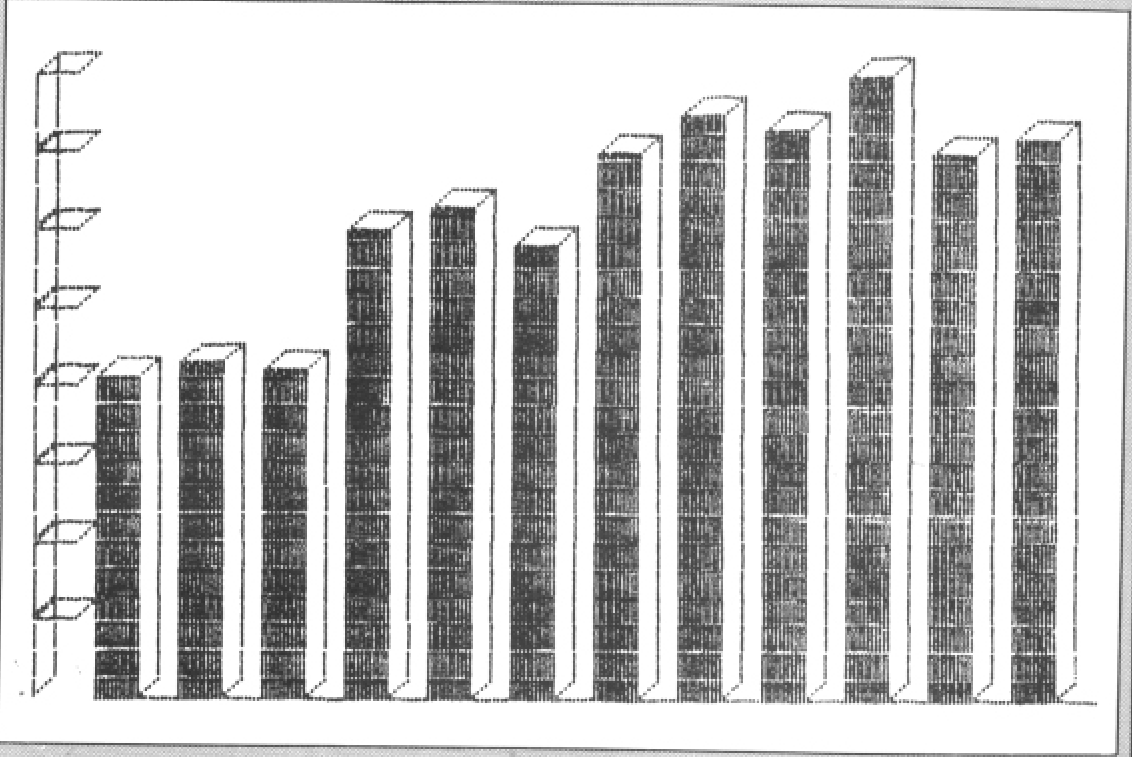
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```
910 'CRASH ROUTINE
920 PUT(X1,Y1)-(X1+40,Y1+35),B
940 CIRCLE(X1+20,Y1+35),30,3,.5,.5,0
950 CIRCLE(X1+20,Y1+35),30,3,1,.5,0:PAINT(X1+20,Y1+10),2,3
960 FORI=1TO500:NEXTI
970 PUT(X1,Y1)-(X1+40,Y1+35),B
980 CIRCLE(X1+20,Y1+35),30,3,1
990 CIRCLE(X1+20,Y1+35),30,3,.5
1000 PAINT(X1+20,Y1+35),2,3:PAINT(X1+20,Y1+10),2,3:PAINT(X1+20,Y1+53),2,3
1010 FORI=1TO500:NEXTI
1020 PUT(X1-10,Y1)-(X1+55,Y1+60),B
1030 CIRCLE(X1+20,190),30,3,.5
1040 PAINT(X1+20,187),2,3
1050 DRAW"BM"+STR$(X1)+",130;BD8U6E2R4F2D2NL8D4BU8BR4ND8R5F1D2G1L5R2F4BR4U4NU4R6
NU4D4BR4U4NU4R6NU4D4BR4U2BU2U6"
1060 FORI=1TO1000:NEXTI
1070 RETURN
```

# How to draw a 3-D bar graph

*From R Dodd in Surrey*

THIS PROGRAM TAKES 12 values, scaling them down if necessary. The values are then drawn as a 3-D bar graph.



**Program notes**

| | |
|---|---|
| 10-50 | Titles. |
| 60 | DIM's array for values. |
| 70-120 | Instructions. |
| 130-160 | INPUTs values. |
| 170-200 | Scales values if necessary. |
| 210-310 | Draws graph. |
| 320-360 | Draws axis. |
| 370-390 | PAINTs one face of each of the bars. |
| 410 | Waits for key press. |
| 420-460 | Asks if you want graph dumped to printer. |
| 480 | INPUTs title for graph. |
| 490-510 | Centres title and prints it. |
| 510 | Returns to high resolution screen. |
| 530 | Sets printer to graphics mode. |
| 540 | FOR NEXT loop for moving across the screen. |
| 550 | Sets printer bits by adding appropriate number to the first byte. |
| 580 | Moves down screen seven rows. |
| 590 | Sends carriage return. |
| 600 | Goes back to 540 to start calculating next block of the screen. |

**Variables**

X — FOR NEXT loop for entering values.
B(X) — Array for holding values.
S — Scale factor.
S1 — FOR NEXT loop for working out scale factor.
S2 — FOR NEXT loop for scaling values.
Y — FOR NEXT loop for drawing graph.
P — FOR NEXT loop for painting bars.
A — Whether you want a printer copy or not.
TS — Title.
SC — X co-ordinate of screen copy.
SD — Y co-ordinate of screen copy.
A — Value of byte.

```
10 REM ***********************
20 REM *    3-D BAR GRAPH    *
30 REM *          BY         *
40 REM *    RICHARD DODD     *
50 REM ***********************
60 CLS:DIM B(12)
70 PRINT TAB(10);"3-D BAR GRAPH"
80 PRINT:PRINT"WITH THIS PROGRAM YOU CAN ENTER A TOTAL OF 12 VALUES WHICH WILL B
E SCALED IF NECESSARY AND THEN DRAWN AS A '3-D' BAR GRAPH."
90 PRINT
100 PRINT"THE PROGRAM ALSO ENABLES YOU TO DUMP THE SCREEN TO THE SEIKOSHA GP-100
A PRINTER"
110 PRINT
120 PRINT"ANY KEY TO CONTINUE":EXEC 41194:CLS
```

**Continued on page 69**

```
130 REM **INPUT VALUES**
140 FOR X=0 TO 11
150 PRINT"VALUE";X+1;:INPUT B(X)
160 NEXT
170 REM **SCALE VALUES**
180 S=S+0.25
190 FOR S1=0 TO 11:IF B(S1)/S>160 THEN 180 ELSE NEXT S1
200 FOR S2=0 TO 11:B(S2)=B(S2)/S:NE^T S2
210 REM **DRAW GRAPH**
220 PMODE 4:PCLS:SCREEN 1,1
230 FOR Y=15 TO 239 STEP 20
240 LINE(Y,180)-(Y,180-B(Y/20)),PSET
250 DRAW"E5R10"
260 LINE-(Y+15,175),PSET
270 LINE-(Y+15,175-B(Y/20)),PSET
280 DRAW"G5L10R10"
290 LINE-(Y+10,180),PSET
300 DRAW"NL10E5"
310 NEXT
320 REM **DRAW AXIS**
330 FOR X=160 TO 20 STEP -20
340 LINE(1,X)-(10,X),PSET
350 DRAW"E5L10ND19G5D19E5"
360 NEXT
370 FOR P=22 TO 260 STEP 20
380 PAINT(P,179)
390 NEXT P
400 DRAW"BM22,180;R245"
410 EXEC 41194:'ANY KEY TO CONTINUE
420 REM **SCREEN DUMP**
430 CLS:PRINT @ 230,"PRINTER COPY";:INPUT" (Y/N)";A$
440 IF LEFT$(A$,1)="N" THEN RUN
450 IF LEFT$(A$,1)="Y" THEN470
460 CLS:GOTO 430
470 CLS
480 PRINT @ 230,"TITLE";:INPUT T$
490 PRINT #-2,CHR$(15)
500 D=16-(LEN(T$)/2)
510 PRINT #-2,TAB(D);T$
520 PMODE 4,1:SCREEN 1,0
530 PRINT#-2,CHR$(8)
540 FOR SC=0 TO 255
550 A=PPOINT(SC,SD)*1+PPOINT(SC,SD+1)*2+PPOINT(SC,SD+2)*4+PPOINT(SC,SD+3)*8+PPOI
NT(SC,SD+4)*16+PPOINT(SC,SD+5)*32+PPOINT(SC,SD+6)*64+128
560 PRINT #-2,CHR$(A);
570 NEXT
580 SD=SD+7:IF SD>190 THEN END
590 PRINT #-2,CHR$(13);
600 GOTO 540
```

# Turbo

*From A Thompson in East Sussex*

TURBO IS A game in which you have to drive a car through a lot of slow-moving traffic. You use the left and right arrow keys for movement and to accelerate you press the 'A' key. There are instructions in the program.

In lines 70 and 80 a machine code program is loaded. This is used when you crash. The machine code program clears the screen in every character from 128 to 255 and makes a sound, going up in frequency.

```
10 CLEAR200,29999
20 CLS0:PRINT@132,"DO YOU WANT INSTRUCTIONS(Y/N)?";
30 A$=INKEY$:IFA$=""THEN30
40 IFA$="Y"THEN300ELSEIFA$<>"N"THEN30
50 L=5
60 X=15
70 FORP=30000TO30033:READA$:POKEP,VAL("&H"+A$):NEXT
80 DATA8A,80,8E,04,00,A7,80,8C,05,FF,23,F9,37,8C,34,02,BD,BA,B3,BD,BA,C5,BD,BA,D
6,BD,BA,D4,35,02,8B,01,81,00,27,03,7E,75,32,39
90 CLS
100 A$=STRING$(9,128)+"                    "+STRING$(9,128)
110 PRINTA$;
120 IFPEEK(1024+X)>127THEN200
130 POKE1024+X,86
140 IFPEEK(343)=223THENX=X-1
150 IFPEEK(344)=223THENX=X+1
160 POKE1480+RND(14),143+RND(7)*16
170 S=S+1
180 IFPEEK(338)=251THENPOKE65495,0:S=S+1:ELSEPOKE65494,0
190 GOTO110
```

```
200 EXEC30000:PRINT@203,"YOU CRASHED!";:FORP=1TO500:NEXT
210 PRINT@448,"YOUR SCORE IS"S
220 L=L-1
230 IFL<=0THEN280
240 IFL>1THENPRINT"YOUR NUMBER OF LIVES ARE"L:ELSEPRINT"YOU HAVE ONE LIFE LEFT"
250 X=15
260 FORP=1TO2000:NEXT
270 CLS:GOTO110
280 PRINT"YOU HAVE NO LIVES LEFT"
290 POKE65494,0:END
300 CLS:PRINT" TURBO IS A GAME WHERE YOU HAVE  TO DRIVE A CAR THROUGH HEAVY    S
LOW MOVING TRAFFIC.             YOU ARE SHOWN ON THE SCREEN AS  'V' AND ALL THE O
THER CARS ARE  COLOURED SQUARES."
310 PRINT" YOU USE THE LEFT AND RIGHT       ARROW KEYS TO MOVE LEFT AND      RIGHT
 AND TO ACCELERATE, PRESS  'A'. WHEN YOU ACCELERATE YOU    MOVE TWICE AS FAST AN
D YOU GET  A BETTER SCORE."
320 PRINT:PRINT:PRINT" PRESS THE SPACEBAR TO PLAY"
330 IFPEEK(345)<>223THEN330
340 GOTO50
```

# Classified

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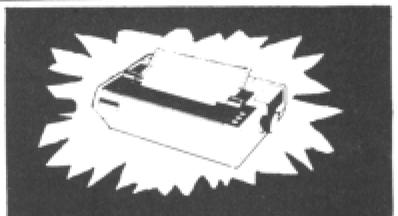
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If you've got a technical question or problem write to Brian Cadge, Dragon Answers, *Dragon User*, 12/13 Little Newport Street, London WC2R 3LD.

# Dragon Answers

## The PLOT revealed

I HAVE owned a Dragon 32 computer since May and have got used to most things, but as I owned a ZX-81 before I am not used to the Dragon not having a PLOT statement. What is used instead of this function?

Also, could you tell me how to colour the graphics in once I have mastered them?

*Dominic Grace, Cleveland.*

**THE DRAGON'S equivalent of a PLOT statement is PSET. In fact this is almost exactly the same as a PLOT except that it also takes into account the colour of the point to be plotted. The correct syntax for the command is PSET(X,Y,C) where X and Y are the co-ordinates and C is the colour of the dot from 1 to 8. This last parameter can be left out, in which case the dot will appear in the last colour used. Another point to note is that the position 0,0 on the Dragon is top left and not the conventional bottom left as for graphs.**

**The other situation where you may find a PSET statement is on the end of a LINE or PUT command. This simply means set the line or shape to the original colours selected — its partner is PRESET, the equivalent of UNPLOT. This has the same syntax as PSET, except that a colour is not required — the dot is turned off — set to the background colour. Again, this also applies to LINE and PUT statements as well.**

## A maths problem

ON MY Dragon 32 (purchased last October) particular mathematical errors occur:

5 ↑ 4 = 625.000001
5 ↑ 7 = 78124.9999
5 ↑ 8 = 390625.001
5 ↑ 10 = 9765625.01, etc.

When operated 5 × 5 × 5 etc the answers are correct. Perhaps you would be kind enough to comment.

*M Fowler, East Cowes.*

**SINCE A competition we ran a few months ago, it seems everyone has suddenly noticed this bug in the floating point maths of the Dragon. This is in fact quite a well-known feature of most Microsoft Basics. The floating point number is held as five bytes in the variables, but when using the exponential function error bits can cause the last decimal place to be + or − 1 out. To avoid this try using A=FIX(X ↑ 4+0.1) or alternatively use A=X*X*X*X which will be a lot more accurate.**




## Joystick interface

DO YOU know of any UK-based companies that sell an interface which would allow me to use my Atari joysticks on the Dragon?

*Stephen Ward.*

**AN INTERFACE to use Atari joysticks on your Dragon is available. It is called the "Dragontamer" and plugs into the normal joystick ports; it will work with most programs except those that require more than left/right/up/down. The interface costs £9.90 and is for one joystick. It can be obtained from Mr MICRO, 69 Partington Lane, Swinton, Manchester, M27 3AL.**

**If you want a two-in-one adaptor, the US company Spectrum Projects is offering its adaptor direct to UK Dragon owners for $29.95 in US funds. Its address is 93-15 86th Drive, Woodhaven, NY 11421, USA.**

## Rerunning on error

I UNDERSTAND there is no ON ERROR RUN statement on the Dragon, I presume you could do this by POKEing somewhere.

*Sam Wardill, Rugby.*

**THE DRAGON has no ON ERROR RUN statement or any similar statement such as ON ERROR GOTO. The new disk Basic does have this facility added, but if you want to add your own programs the short machine code routine listed will rerun the program whenever an error occurs.**

**The routine works by intercepting the error handling routine and jumping to a RUN command. You can locate it anywhere in the memory — I have put it at the top above Basic. You may disable it by typing POKE 401,57 and enable it by typing POKE 401,126.**

```
10   CLEAR 200,32749
20   FOR I=1 TO 10:READ
     A$:POKE 32749+I,VAL
     ("&H"+A$): NEXT
30   DATA 32,62,BD,84,1F,
     BD,83,ED,7E,84,9F
40   POKE 402, 127: POKE
     403, 238
50   POKE 401, 126
```

## Concurrent operation

I WOULD like to know if it is possible to use a Dragon disk controller and Rom cartridge (eg the Hi-Res cartridge from Compusense) at the same time.

Is there an expansion-box available in the UK?

*P Heide, West Germany.*

**THE DISK drives for the unexpanded Dragon 32 are controlled by an extension to the existing Microsoft Basic. These extra 30 or so commands are held in two 4K eproms in the disk controller cartridge and are addressed from 49152 onwards. This is the same area of memory that most usual cartridges use (including the Hi-Res cartridge), so even if you got an expansion box to plug more than one cartridge in, only one could be accessed at once. There are none of these available in the UK, but there is one available from the USA for the TRS80CC which may be compatible, but this will not allow you to use disk drives at the same time as any other cartridge.**

**While on the subject of disk drives, users should also note that 1½K of memory from 1536 to 3071 is used by the mini DOS and so any tapes which load into this area cannot be used either (eg, Frogger, Ninja Warrior, Bonka, etc). As the drives become more generally available most of these games will probably appear on disk anyway.**

## Keyboard problem

I DO not understand fully how to read the keyboard in my machine code programs. I have no trouble deciding in which row a key is being pressed but I can only obtain a value of zero from FF02.

Could you please tell me where or how the computer notes the contents of this address as this is halting my machine code writing.

*Patrick Skelton Kellington.*

**THE TWO locations you need to look at are $FF00 and $FF02. The confusion arises because the first is programmed as an input, but the second is an output — the column select register. You store the data in $FF02 and then compare it to the contents of $FF00 to isolate a single key. The computer stores its own results in the keyboard rollover table from addresses 336 to 345; however, it's no use trying to use this in machine code as it is only updated by Basic.**

**Unless you want to check for more than one key pressed at a time, by far the simplest way of reading the keyboard is to use the keyscan ROM routine in your program. This is called by many of the cartridges available and is the standard way of reading keyboard input from machine code. The subroutine is used by JSR 48101 and on return the 'A' register will contain the ASCII code of the key pressed. This routine also takes care of the Caps Lock function and always returns the correct value.**

# Competition Corner

Answers to Competition Corner, *Dragon User*, 12/13 Little Newport Street, London WC2R 3LD

## The Prize

THIS MONTH'S prize is a Dragon 64 from Dragon Data. The 64 can use Basic, Pascal and Cobol. It has three operating modes — a 32 mode allowing operation as a Dragon 32; a 48K mode giving 48K Ram and 16K Basic Interpreter; and a 64K mode.



## Contest rules

YOUR ENTRY must arrive at Dragon User by December 23. The winner and solution to the puzzle will be printed in the March issue. You may enter the competition only once. Entries will not be acknowledged and no correspondence will be entered into.

# Use your imagination and win a Dragon 64

*Tell us the most interesting use you can think of for a Dragon 64 and solve the puzzle by* ***Gordon Lee*** *– and a 64 could be yours!*

THE DRAGON 64 is a new machine, so this month we're taking a new approach to our competition, introducing a two-part puzzle.

First you have to suggest the most interesting application for a Dragon 64 in 60 words or less — let your imagination run free (well, not too free), but try to make your answer match the quality and characteristics of the machine.

The second part of the puzzle involves solving the problem set at the end of this article. But first try your hand at some Dragon-assisted computer games.

The arrival of December 25 will also mean that many a Christmas stocking will be bulging with a new micro-computer. As this time of year is also a time for party games, why not involve your computer in some of these activities?

Of course, there is a wide range of games available on cassette, but it is also possible to program a computer version of some of the more traditional games. Often, only a dozen or so program lines are necessary, and you can make the games as elaborate or as simple as you like. Whereas Aunt Edna might be somewhat out of her depth zapping alien spaceships, she will no doubt enjoy some of the more familiar games. Try this short program:

```
10  DIM TOPIC$(25)
20  FOR N = 1 TO 25: READ
    TOPIC$(N): NEXT N
30  DATA A FLOWER, A COUNTRY, A
    BOYS NAME, A DOMESTIC ANIM-
    AL, A T.V. PERSONALITY, A CAPIT-
    AL CITY, . . . etc.
40  to 60 (DATA lines as necessary)
70  CLS: PRINT "TO PLAY PRESS ANY
    KEY"
80  Z$ = INKEY$: IF Z$ = "" THEN 80
90  CLS: A = RND(25): L = RND(26) +
    64
100 PRINT @ 96, TOPIC$(A): PRINT @
    487, "NOW PRESS ANY KEY"
110 Z$ = INKEY$: IF Z$ = "" THEN 110
120 PRINT @ 271, CHR$(L)
130 Z$ = INKEY$: IF Z$ = "" THEN 130
140 GOTO 70
```

The DATA lines 30 to 60 should contain the 25 "topics" used in the game, though this number can be increased if you wish.

To play, the computer selects a topic — say "A FLOWER" — and then chooses at random a letter — for instance "J". The players must then think of the name of a flower beginning with this letter. Sorry, "Jeranium" won't do! Touch a key and the next topic will be displayed. Award a point to the player who is first to call out a correct answer.

Another old party game ideally suited to the computer is Consequences. Each player thinks of a story along the lines of:

"A boy met a girl at ——— (place). He said to her '———'; she replied '———'. And the consequence was ———."

The computer should be programmed to store the relevant parts of each player's story in a series of dimensioned arrays. So, for six players the arrays would be set up: DIM BOY$(6): DIM GIRL$(6): DIM PLACE$(6), and so on. Each player would then enter his story in turn, prompted by cues — (PRINT @ 0, "ENTER A BOYS NAME").

When this has been done, the computer selects each component part of the story at random from all those entered and prints out the result — putting in the linking words of text to make the complete story.

The beauty of the computer version of the game is that many different stories can be generated from the same sets of data by just re-selecting at random. In theory, at least, there would be more than 46,000 different stories possible with just six players!

If you have any favourite party games, why not try out a computer version?

And now to the second part of our competition, 'Santa's Dilemma'.

'Twas the day before Christmas, and far, far, away  
Old Santa was busy with packing his sleigh.  
To be on the safe side, so nothing was missed,  
He'd taken the trouble to write out a list:

**DOLLS — 12996**  
**SWEETS — 175561**  
**CAMERAS — 1098304**  
**PUPPIES — 1311025**  
**TRUMPETS — 14032516**  
**BICYCLES — ?**

But one missing number caused Santa to frown;  
**How many bicycles should he write down?**

## October winner

The winner of October's competition and recipient of a modem and RS232 interface from Cotswold Computers and CP Engineering is C T Callow of Reading. Eight sets of numbers fitted into the grid

| | |
|---|---|
| 1283, 107, 7649, 359; | 1259, 107, 7643, 389 |
| 1523, 107, 7649, 389; | 1259, 167, 7043, 389 |
| 1409, 167, 7523, 389; | 1409, 167, 7253, 389 |
| 1249, 157, 7603, 389; | 1429, 157, 7603, 389 |

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